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SURVEYING AND MAPPING

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DEVOTED TO THE ADVANCEMENT OF THE SCIENCES
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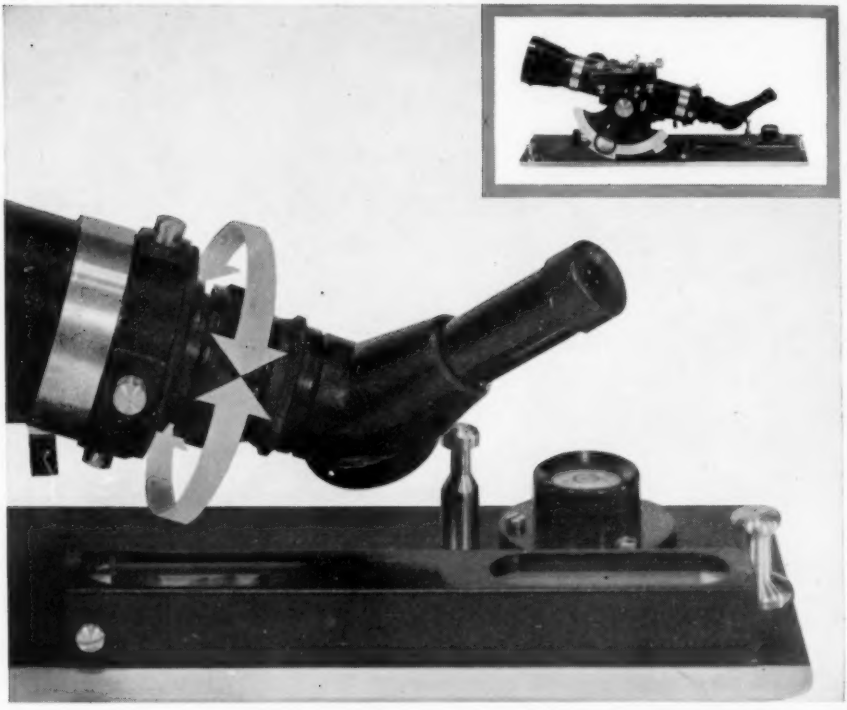

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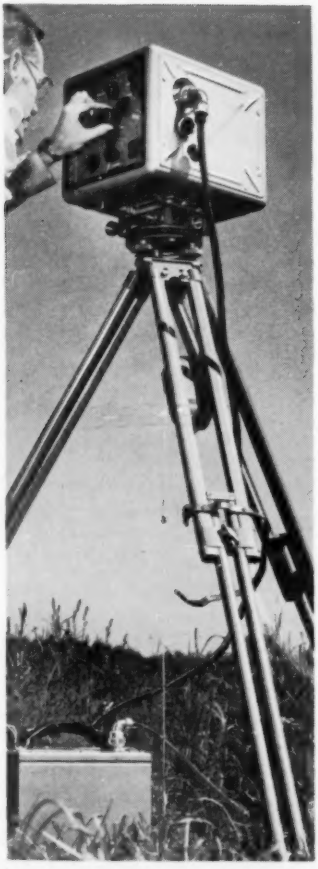

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Introducing the New President of ACSM

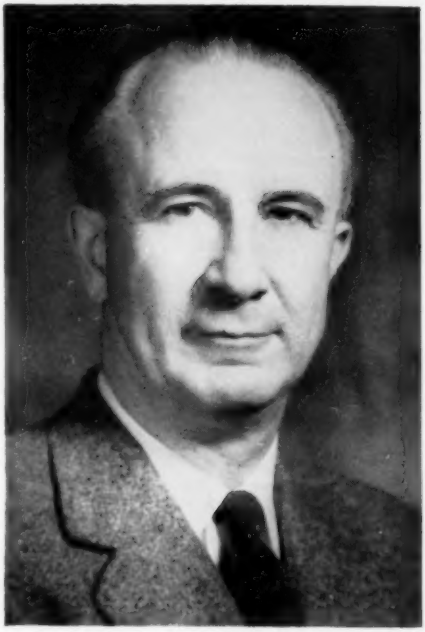
George C. Bestor, 1959 President of ACSM, was born July 10, 1902, in Minneapolis, Minnesota. He received his formal education there, interrupted by a year between high school and college spent on construction surveying with the Alaska Railroad Commission. In 1924 he received his B.S. degree in civil engineering from the University of Minnesota.

The years following college were spent in the oil business, both in this country and in Australia. In the latter, he pioneered the American-type filling stations, inaugurating a chain of them in Melbourne. Returning to the U. S. in 1930, he spent some time in the importing business and then was called to active duty with the Civilian Conservation Corps as an Army Reservist. His wartime service was with the Coast Artillery, serving in Texas, North Carolina, and Alaska. During this period his hobby was writing, and he published three mystery novels, several short stories, and various articles.

Finally, released from the service in 1945, he was able to return to his first love, surveying. Since that time, he has been engaged in private practice in Carmel, California. In addition to a land surveying service, his practice embraces general civil engineering and specializes in subdivision work, land planning, and in street and utilities design for military housing projects. In recent years, his office has done the engineering for more than 3,400 housing units at various Army and Navy installations in California.

In 1958, George was President of the California Council of Civil Engineers and Land Surveyors, an association of 230 firms in practice in that State. His nearest return to the literary muse was a compilation for this professional group of "City Planning—A Basic Bibliography with Special Reference to Civil Engineering and Land Surveying," which has received wide distribution from Moscow to Manila and is now in its second printing. It is one of George's strong beliefs that surveyors and engineers should take a deeper interest in Planning, a field which once was theirs.

As for his ACSM activities: George joined the Congress in 1951, as a charter member of the Northern California Section, and was elected national Vice President in 1958. As Vice President, one of his activities was sponsoring the Western Regional Conference of ACSM in Monterey, California, last October, attendance at which exceeded 500. Together with President W. B. Williams, George attended the Congress of the International Federation of Surveyors, in Delft, Holland, last summer, where he presented a personal report on "The Status of Surveying in the U. S. A." Bestor also stimulated formation of the new ACSM Sections in Oregon, Utah, and Arizona by visiting these States and calling upon surveyors there to meet and discuss formation of local organizations.



Photograph by Murle Ogden

GEORGE C. BESTOR

One of his ambitions for his term as

(Continued on page 140.)

Art and Common Sense in Cartography

By RICHARD EDES HARRISON

CONSULTING CARTOGRAPHER

I THINK I should explain myself a little bit because I do not believe that I am too well known to the members of the Congress, especially since my work hasn't been published much in recent years.

As a cartographer, I rather defy classification; I have had no training in cartography, have no boss, no supervisor. But I do have editors. (I hope there are no editors present because, confidentially, it is only editors that give me trouble.)

I do not have to follow manuals and beyond selecting or adjusting a certain pen, I don't even measure the width of lines.

I am making this horrible confession because it means that I have attained a kind of detachment from the conditions and procedures current among the main map-producing agencies in this country, whether they be institutional, commercial, or governmental.

This rather personal introduction is being made because I feel strongly that some phases of our cartography are in need of scrutiny from a detached source.

The sum total of our national effort in making maps must be staggering. We undoubtedly produce more than any other country. While they display many excellent qualities and certainly a superior technology, too often they do not match the best efforts of several foreign countries. We have yet to equal the British Ordnance Survey maps at large scales, the Swiss staff maps or the privately produced maps of Kümmerley and Frey, and fine cartography is the order of the day in Italy, Germany, Sweden, and even Poland. A few years ago, here in Washington, we were treated to some French physiographic sheets that were most original and beautifully produced. Lately, in the atlas field, the western world has been astonished at the general excellence of two Russian works, the Atlas Mira and Atlas Morskoi. These easily rank among the finest atlases of this century and we have nothing which begins to approach them in quality.

What are the missing ingredients in American Cartography? As a nation, we are used to obtaining the best of everything; surely cost is not the only factor. Our mathematicians are as competent as any; our mastery of photogrammetry and other phases of gathering geographical information—although I am no expert on this—is undoubtedly first-class. In my contacts with government and private mapping agencies, both as visitor and consultant, I have been impressed with the dedication and ability of the staffs and by their willingness to experiment and innovate.

The drawing these days is precise (sometimes to a fault) and many agencies have made great progress in engraving and printing. In fact, through the introduction of such methods as negative scribing and film stripping, the gap between the final drawings and the printed sheet, always so full of pitfalls and booby traps, has been closed up to such an extent that many problems in this area have been solved or even eliminated entirely. All this is good and encouraging; yet, when you examine the printed sheet, too often you are forced to admit that it does not rank as great cartography.

The ingredients that are missing, in my humble opinion, are three. First, certain gaps in the training of personnel. Second, an unwillingness to accept art as a full partner of technology in the design and drafting of maps. And, thirdly,—this is really a corollary of the second—a too rigid application of technological devices and technological requirements. This could be termed a sort of Manual servitude. In the military agencies, I keep hearing the words "user

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requirements" over and over again. There is only one over-riding user requirement and that is: Can the poor fellow understand the map?

The difficulties of personnel procurement and training have been frequently discussed in the proceedings of this Congress, and we often hear: "Where do you get a good contour man, or lady? Where can we get three topflight compilers?" etc.

These are common questions and they witness the constant search for specialists. But this is not exactly the approach we are talking about here. It seems to me that the failure lies in narrowing the training to the exclusion of an essential, broad knowledge of the subject. In most fields of human endeavor of a high level (and cartography certainly qualifies), it is considered desirable to know what your endeavor is all about. Well, maps are inextricably involved in geography and, yet, in American cartographic establishments, there are entirely too many people making final drawings for maps who have had little or no training in geography. Grade school geography is not enough. It is not as rigorously taught as we might like, and, besides, the average pupil leaves the subject at the seventh-grade level and never encounters it again.

Education in geography and cartography is a large and worrisome problem, but for the purposes of this paper I will confine my self to two examples of how lack of training in this field operates.

The first example occurred sometime ago in that ancient and honorable institution, the Hydrographic Office. One of the working staff was preparing a letterplate involving the northeastern United States. As he was placing the name Meriden in its proper Connecticut location, the supervisor (a man from Oklahoma) peered over his shoulder and said: "Hey! Wait a minute, that's not the way to spell Meridian."

The working stiff replied that this was Meriden, a different place and different spelling; but the supervisor was adamant—he knew how to spell Meridian—and that is the way it was published on the sheet.

Another, and more expensive error, appeared on a map of southwest Asia, published and distributed by the millions a few years ago by an equally ancient and honorable institution which shall remain anonymous. On this sheet, the Indus River exhibited an extraordinary tributary drawn in a single line of maximum width. This was the Kabul River, which breaks through the mountains near Khyber Pass. It continued on past Kabul, crossed a ten thousand-foot pass into the head-waters of the Kunduz River, flowing into the Amu Darya and winding up in the Aral Sea without once diminishing its width. After the error was called to the attention of the Chief Cartographer, he wrote me that the mistake was caused by the compiler who failed to follow instructions and used a Russian map of Afghanistan instead of a British work.

It should be noted that the Chief Cartographer missed the point completely because, even if the compiler made a mistake, the drainage man who inked it in would never have drawn such a monstrosity if he had any knowledge of hydrology or even had an elementary acquaintance with the geography of the region. And what shall we say about the checkers and editors?

All of us, who have had anything to do with the production of an intricate map, know that it is almost impossible to avoid error entirely. (On one of my early maps for *Fortune* magazine, the Galapagos Islands were shown 300 miles south of their actual position.) But a great many embarrassing mistakes will be avoided if personnel have at least a nodding acquaintance with geography, the mother science of cartography. I believe that a definite effort should be made to supplement the geographic training among cartographic personnel. This is not too much of a problem where the establishment is handy to a university with a good geography department. Perhaps some agencies would have to set up their own courses on the premises, so to speak. Perhaps also this is a good time for the profession to review the whole situation of education for cartography.

The chief obstacle in the path of a sound national program is, of course, that it will not deliver quick results. Many of you

local people probably saw that wonderful Herblock cartoon of a few months ago. (Figure 1.) The scene is an orchard. The soil is bare and cracked, the trees have only a few leaves on them, and no fruit is in evidence. An official is talking to the scientist, and he is saying, "Never mind the soil, never mind the trees, make me some fruit!"

"Never Mind About Trees And Soil—
Make Us Some Fruit"

FIGURE 1.—Herblock in *The Washington Post.* (With permission.)

If we are not careful, the current hullabaloo about education will result in a plethora of mathematicians, physicists, and electronic engineers, while competent men in our field will be even more difficult to find than today.

Don't we also have an essential role in the Sputnik Age? Of course we do, and it should not even be necessary to belabor the point.

Before we depart from the subject of training, at least a mention should be made of the meager literature available. A few months ago this observer was horrified at the low quality of the training manual used at one of our armed forces academies. There were actual errors in explaining the projections. Why do we still not have a translation of Eduard Imhof's "Gelande und Karte?" It is neither an insuperable problem to produce good manuals nor to finance translations of the best foreign works.

Now we come to our second point, the unwillingness to admit Art as a full partner of Technology in cartography. The role of Art has not enjoyed very extensive debate on this side of the Atlantic. Is it possible that the dismissal of James Abbott MacNeil Whistler from the Coast and Geodetic Survey for being too "artistic" has served as a strong symbol of the divorce of American cartography from Art?

The great Continental cartographers discussed the matter freely, especially in the latter part of the nineteenth century and the early years of the twentieth century. In 1907, Max Eckert made an attempt to define its role precisely. The following quotation is from a translation by the late W. L. G. Joerg in the *Bulletin of the American Geographical Society* in 1908.

"But how can Cartography (if it is an Art) avoid the rigid rules of mathematical precision? The decisive turning point, in my opinion, lies in the transition from the topographic to the general map. As long as the scale allows the objects in nature to be represented in their true proportion on the map, technical skill alone is necessary. Where this possibility ends, the art of the cartographer begins. With generalization, art enters into the making of maps."

I should like to interject a quibble at this point. Eckert forgot that on even very large scale maps, such as planimetric charts of 1 in 10,000, some generalization is required, and most certainly at the one-mile scale.

Eckert goes on: "In generalizing lies the difficulty of scientific map-making for it no longer allows the cartographer to rely merely on objective facts but requires him to interpret them subjectively. . . . The manner in which this material is to be rendered graphically depends on personal and subjective feeling. But the latter must not predominate. The dictates of science will prevent any erratic flight of imagination

and impart to the map a fundamentally objective character in spite of all subjective impulses. . . . It is in this respect that maps are distinguished from fine products of Art."

(I think this is a mistranslation. It probably should be, "the products of fine art.")

"Generalized maps, and in fact, all abstract maps should, therefore, be products of Art clarified by Science."

In spite of Eckert's quaint "professorese," I think he has made his point, and I agree with him.

On this side of the water, John K. Wright is one of the few bold enough to tackle the ghost of Whistler. In a fine paper (which should be required reading for all involved in this business) entitled "Map-makers Are Human," *Geographical Review,* October 1942, he has this to say:

"Fully as important as scientific integrity is judgment. This embraces critical acumen in the selection of source materials, discrimination in the use of techniques, taste in the choice and arrangement of colors, symbols, lettering, etc., and throughout a feeling of consistency."

This is a broader statement than Eckert's, and I like it even better. "Judgment; discrimination; taste; feeling." Note well the choice of these words. Are they the tools of Science? No, they are rather the tools of Art.

The whole matter was summed up with breathtaking compactness by Pablo Picasso when he said: "Art is not truth—Art is a lie which makes us see the truth."

What good is the best map technology in the world if it results in maps which are confusing or fail in their prime purpose of delineating geography clearly? The most accurate or most scientific one may actually be a poor map. As an extreme example, take a good, sharp, vertical, air photo (it is, of course, not a map; perhaps it is one in embryo). This has an enormous amount of information on it, but much of it is useless to cartography and must be eliminated; the essentials must be painstakingly culled. In short, it requires photointerpretation, and what is interpretation but an art?

Art in cartography is not just a philosophical concept but an intensely practical matter. It enters into major questions of map design, and few of the nooks and crannies of map production can escape it entirely. Beyond those facets suggested by Dr. Wright in a rather general way, it is an art to convert contours to plastic-shading; drawing a river is an art, or drawing a swamp or a boundary. Placing the names on a map is an art and how to select type is hardly anything else (this is a phase that has been invaded by technology in an entirely illegitimate way). Above all, it is an art to control all the elements of line, halftone, and colors so that they result in an accurate, readable, harmonious whole.

What all this means to the mapmaking organization is that it should be far more liberal in hiring personnel with training in the arts (as well as the other essentials), and, what is more important, giving them positions of authority. There is an old saying in the art world to the effect that it takes two to produce a work of art; one to draw it and one to hit him over the head when he is finished. In the special field of cartography, it might well take this form: It takes one to draw the map and another to take the Colonel (or editor) out for a drink until the drawing is safely in the hands of the engraver.

I am quite aware that I have not touched upon many problems that have hampered map producers in their desire to make maps of superior quality. There is the little matter of money. There is, again, the matter of "user requirements." And there is the seeming necessity for rigid specifications. These appear to get worse all the time because of extensive subcontracting and the fact that, in government agencies at least, they are taking in each other's washing with the result that the "specs" get narrower and more rigid (but the manuals get bulkier).

As an outside critic, I can develop plenty of sympathy for these woes, but my main point is that we should be able to produce the very best maps in the world, and my present objective is to try to point out specifically why we are not getting them.

This is the end of the prepared part of my talk and from this point on I am going

to give you some demonstrations and talk more or less ad lib from notes.

SHADED RELIEF

First, I would like to produce a brief discussion of hill shading. Hill shading is becoming a major part of cartography in this country and I believe it is here to stay. The pioneering work of the Geological survey 'way back in the teens, the tremendous impetus given it by the great work of Hal Shelton and his successors, and the excellent work being done at ACIC have put this art on the right track, and we are going to see more and more hill shading incorporated in our general geographic maps.

I was particularly pleased about two years ago, when I visited ACIC, with the general high quality of the work they were doing. I was amazed that the artists were using several methods in producing shaded relief. Some of them used Pasché turbine-type airbrush, some of them used a Thayer & Chandler air brush, one man was doing it with an ordinary brush and wash, and other people were doing it with crayon. I inquired about this and they said they were allowed to use any medium they wanted to.

The amazing thing is that the quality and the character of the work were so similar.

I would like to point out one common weakness in the hill shading as it is done here—that they teach doing it by emphasizing the ridge lines. Your first step is to draw a ridge and your subsidiary ridges, and then you start rendering from that point on down. I used to do this myself, but it results in confusion rather than clarity.

The main objective of shaded relief is to show the mass of mountains or any surface feature, whether it is a meatloaf or a mansard roof, mesa type, or what-have-you. You want to indicate the mass; you are not just interested in knife-edge ridges because these are comparatively unusual topography.

The heaviest shadows are almost invariably at the base of the mountain. The Uinta Mountains are a good example. The main structure is a dome. There are subsidiary valleys, but emphasize those too much and you don't get the feeling of the mass.

I always tell people that the best way of studying this is to make a section; see what it looks like; and then study the shadows that would be cast on the various slopes.

Of course, there are still a few problems involved in printing hill shading in relationship to layer tints or contours and also its conflicts with the letterplate. I think, however, that these matters are on the way to solution.

Another important thing about good hill shading is that, when this is present, the necessity for many contours is eliminated. The better the hill shading—the more effective it is—the fewer contours or layer tints you have to have.

SYMBOLS

Now a word about symbols. A few years ago the Navy spent an awful lot of money studying the visibility of symbols. I think this was largely wasted, because I believe that the visibility and design of symbols is a matter of common sense and some artistic feeling. Any good graphic artist can tell you if a symbol is good or if it is bad.

I can illustrate my feelings on the matter pretty well by discussing a specific episode. There is no harm in mentioning the agency involved, which is ACIC, because this particular story had a happy ending. They submitted to me a sheaf of pages in which they had several hundred symbols drawn in perspective. They were drawn very neatly and they were very impressive. These were designed so that various cultural objects could be recognized from an airplane. This was my evaluation; "In spite of the nice drawing and impressive variety of these symbols, I am forced to conclude that this project was headed in the wrong direction. In the first place, the very number of them is self-defeating. In only three categories, the factories, public buildings, and bridges, 114 symbols have been amassed. After all, there are only 26 letters in the alphabet. If the ruckus about education is true, we have plenty of trouble learning 26 letters.

"If I were running this show, I would

have one symbol for dams instead of 17, and let the shape of the reservoir serve to identify it. Reservoirs have an infinite variety of shapes, but they all look like reservoirs if they have a dam symbol.

"You have so many public buildings that some of them at first glance look like dams, some of the dams look like factories, some of the factories look like public buildings such as churches.

"The quarry symbol, incidentally, puzzled a lot of people. It looked to one observer like a busted tea cup.

"In the second place, I question very seriously whether symbols in perspective belong on maps that are not in perspective. It seems to me that the whole discipline of map reading is jeopardized by this kind of symbol. As you know, I got my start in journalistic cartography where these were considered 'just the thing' by editors, but I combed them out of my system 20 years ago, and I hate to see a respectable outfit like ACIC use them.

"My advice is to sell the entire lot to *Time* or *Newsweek* at a handsome profit.

"In a more constructive vein, I have given some thought to this problem, and I have started experimenting with cast shadows to emphasize important structures. There hasn't been too much progress and my optimism is restrained.

"As I see it, the biggest obstacle is the matter of scale. On a well-ordered map, scale is not only designated in a conventional way, but a visual scale is established for the user by carefully drawing, true to scale, various features such as the configuration of coasts, streams, lakes, and the exact outlines of cities.

"This is sort of a psychological scale. The smaller the scale of the map, the fewer the items which can be shown in true scale. For most natural features this is handled by generalization, but the cultural items, when too small for true scale, are converted to symbols. The mere fact of this conversion tells us something important about the scale and this is why a symbol should be just that and not a representation. The latter tends to destroy the visual scale for the map user."

The next time I was in St. Louis, the ACIC showed me a new list of 16 symbols which was to replace the former one of 200 plus. This was the happy ending.

REVERSALS

In Volume 126, No. 3277, October 18, 1957, of *Science* there appeared a rather important article, "Geology From The Air," by R. C. Way and W. A. Fisher. This is a very interesting and unusual extension of the uses of photointerpretation and air photos in geology, but I was surprised, when I looked at it, to find that all of the air photos "reversed" on me. The authors were trying to demonstrate, for example, a crater in one place, but it looked like a cone. I hunted through the article and could find no mention of the fact that reversals have to be watched for when you are making interpretations of air photographs or even looking at them as illustrations in an article. So I harked back to an episode of a long time ago. The second issue of *Life* (Nov. 30, 1936) ran this photograph. (Figure 2.)

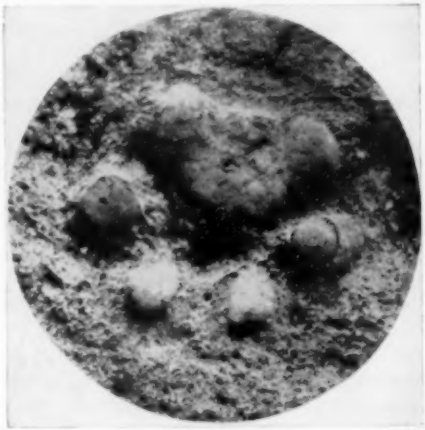

FIGURE 2.—Vertical photograph as originally published in *Life*. Photograph by Commander Geo. M. Dyott, in *Life*, Nov. 30, 1936, p. 66. Reproduced without permission.

Is that visible in back of the room? This is a vertical photograph, and, unless I am mistaken, these five features appear as elevations. Is there anybody in the room to whom they do not appear as elevations?

It doesn't look like a depression to anybody?

That is a beautiful example of a reversal. (Figure 3.)

I have done a lot more thinking about

FIGURE 3.—Same photograph as in Figure 2 but rotated 180° so that light comes from the top.

reversals and their relationship to cartography; also the psychological background. Why do things reverse? I know this bothers the Air Force, and it should bother the photointerpreters; but I don't know whether it does or not. But it is a serious problem. They make a very accurate piece of hill shading, and when the map is turned upside down it reverses on them. They don't understand why.

I am convinced that this is based on optical effect. The average human being is conditioned almost from birth to lighting above his horizon. The sun is above the horizon when you see it, the moon is above the horizon, street lamps, the average interior lighting, even domestic lighting is practically always above the level of the eye. So, when you pick up a magazine and look at an air photo, your assumption is that the light is above the horizon.

From a study of Figure 4, I think you can arrive at a formula for using an air photo or any vertical photo as an illustration.

It is perfectly true that an expert photointerpreter can perform the reversal consciously. You deliberately visualize that the light is from this direction and therefore this should happen. And you begin to see the shadows reversed. But when you blink your eyes it is very apt to snap back to the original aspect.

In order to avoid the possibility of reversals while studying air photographs, the source of light should always be in the top quadrant; i.e., within 45° of the top median line. This means in practical terms, that air photos taken in the southern hemisphere should have *north* at the top, since, during the normal hours of air photography, the sun will range approximately from northeast to northwest. But in the northern hemisphere, *south* should be at the top, because then the sun will again be in the top quadrant, and no reversals will be encountered.

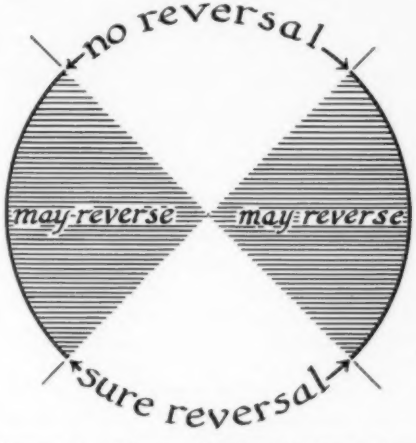

FIGURE 4.—Diagram showing incidence of reversals, according to the source of light.

While I was working on this formulation I suddenly had a dangerous thought. I was thinking of the trouble that the Air Force has had with reversals in hill shading, and also the fact that you have to commit an astronomical lie every time you do hill shading. It is generally recognized in topographic circles that your light source has to be upper left or upper right.

But, in the northern hemisphere, the sun

is never in either of these positions, and this bothers people. I know it bothered people when I first started doing crazy maps for *Fortune*. People used to object: "But, look, you've got the sun in the wrong place; it couldn't possibly be there."

The dangerous thought is that all maps —and if you don't like this, please don't shoot me until the middle of April—all maps in the northern hemisphere should have south at the top, and all maps in the southern hemisphere should have north at the top. Then you could have the sun in the proper astronomical position and no reversals.

That is not as crazy as you might think it is, because there is no special reason why north has to be at the top. Actually, if you saw a map of the United States upside down, you would suddenly be aware of the true shape of the United States much better than by looking at it in the normal position. You are so conditioned when north is at the top that you no longer have any idea of the shape of this country. If you take 50 people in this room and get each to draw a freehand map of the United States, you would be astonished at the results, including mine.

LINEWORK

Well, I think I have disposed of three of my topics. Now, I would like to talk a little bit about line work on maps.

The disposition of widths and character of the line work on a map is really what decides whether it's a legible map or not. There is an intense competition between all the elements—contours, railroads, rivers, roads, names of places, and symbols. And these are all things you have on an ordinary geographical map. When you have a map for special user requirements, you sometimes have to have a great deal of other information on it—air charts, for example.

There is one rule, and that is everything that you draw on a map should be precise and recognizable in itself; it should have its own character. For example, a line for a river should never be drawn similar to a line for a railroad. There has to be complete separation. And this is sometimes a matter of great delicacy; shore lines and boundary lines, for example.

The recent development of scribing is a wonderful thing. However, I think it should be restricted to lines which are constant in width. It is excellent for roads, railroads, even shorelines because, after all, a shoreline is a symbol, not a representation. The shoreline is just a meeting place between land and water. It is not like a river where you really represent the width of something. So it is perfectly all right to scribe shorelines, if you want to, but not rivers. I am going to go into rivers a bit more later on.

Incidentally, I understand that there is some dispute about the origin of scribing, or who was responsible for developing it. I have absolutely no information on this subject, but I would like to tell you a story which seems apropos. I am sure it is all right to tell this story, because it was told by the President of Yale University at an alumni luncheon with the widow of an ex-president sitting right in front of him.

A small boy came tearing around the corner, ran up to a policeman, and said, "Hey, my father's in a terrible fight. Can you come and help?"

The policeman grabbed his billy, lumbered around the corner, and, sure enough, there in the gutter were a couple of guys fighting like mad and banging each other's heads on the curbstone. The cop said, "Well, kid, which is your old man?"

He replied, "That's just it, they don't know. That's what they're fighting about."

I think that, especially among the military agencies, the line work is not good, rather, the design of their line work. Once having established the way of doing it, it's all right, but I don't think it serves its purpose.

Now you take boundaries, for example. (*See* Figure 5.) I am not too optimistic about whether you are going to be able to see all of this demonstration. But, there are a lot of ways of drawing a boundary line, and I have to exaggerate. First, you have one which is drawn with a Leroy pen and it looks something like that. The lines are rounded at the ends. And then other

people will draw them this way. Say this is an international boundary. Can you see that? They are the biggest boundaries I ever drew. Some people believe that the dot is not a dot; that it is merely just a shorter dash. I think both of these types are extremely unsatisfactory when you have a tortuous boundary situation. You are all right when it is a surveyed line crossing the Sahara Desert, you can follow it easily; but where it is tortuous, whether it follows a stream or whether it is the boundary of Monaco or Georgian enclaves in the USSR, or something like that, they don't tell you anything. They fracture or disappear.

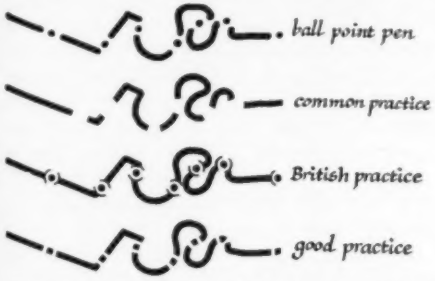

FIGURE 5.—Four ways of drawing boundaries.

The British used to draw them like this. They recognized the fact that the dot interrupted the continuity of the line. This was hand drawn and it got over the visual interpretation of the dot fairly satisfactorily. But it is slavery to do this. There is no mechanical way to do it. And obviously we are not going in for slavery.

When you draw a boundary as a continuous line and interrupt it very carefully, no matter where it goes you have an edge which is continuous. When you break this you break it at a minimum. In other words, your white (whether this be done with an opaque white or a knife) should be less than a square, so that the edges still show a visible continuity.

When you draw a boundary line like that it will always look like a boundary line and it will always be clear. The width of it, of course, has to be appropriate to the importance of the boundary for that particular kind of map. But the other methods are just too loose and the boundary fragments; pieces of it get mixed up with other things, like lettering.

When you have thin lines it is important to bear in mind that there is a certain threshold of color perception. A good example of this is in the new Russian atlas, Atlas Mira, (one of the few poor things about it) where roads and tracks are single black lines, quite thin. The headstreams of rivers are also quite thin, almost the same width, and when the river is printed over heavy layer tints it is impossible to tell the difference.

I recommend, even at the sacrifice of scale, that rivers may be made wider than you would think normal—and use a paler color. Then you will be able to separate them from the other line work.

Rivers are especially poorly treated in the manuals. The instructions of some of the agencies read somewhat as follows: You can start off with a thin line, but at the headwaters and within a half-inch it has to reach a thickness of seven-thousandths of and inch, and it proceeds at this width until the river is more than one-tenth of an inch wide at that scale; then you begin to draw it with a double line to true scale.

This results in some rather odd delineations. In the first place, you cannot follow the stream above the point where it is shown as a double line. There are many, many examples of this on aeronautical planning charts, jet charts, and other maps produced by military agencies, the drainage is extremely illegible. Jet Chart—I think it's JN-37—shows how this is reduced to an absurdity. The Sutlej River, for example, runs for 300 miles gathering glacier water from a fairly large basin. It comes down through the Himalayas and is quite a stream. This is shown as seven-thousandths of an inch wide all the way. When it reaches the plain it suddenly becomes one-eighth of an inch wide, 0.125 wide. This is just absurd because it is a braided stream; the stream is just as important above as it is below, perhaps more important. It has the same amount of water. Just because it is spread out does not mean that you have

to go in for this drastic constriction above that point.

I have had a man working for me who used to be at the Hydrographic Office, and when I showed him how I draw rivers he was astonished. I instructed him to draw the headstreams of all branches and then, as you gather them, where you have confluences, you just bear down on the pen and make the river wider. And in a short time he said, "This is amazing." He said, "This looks like a river."

I asked, "Don't they ever do that down there?"

He replied, "Oh, no, we are not allowed to."

There is no reason why a river should have a constant width. There is no river in the world that does have a constant width. It is right to do it for canals, but not for

FIGURE 6.—The function of the serif.

rivers. Even if the line has slight irregularities, so what? It looks like a river. This is one thing which can reduce confusion on maps, if things look like what they are supposed to look like.

Well, that settles that. I hope.

TYPE

Now, I think the last thing I will talk about is type. I will say little about it except that I believe this is another area where we are in real trouble—specifically, in the use of sans-serif type on maps.

I use sans-serif type for certain things, but only if you want to name a railroad, or some such cultural feature shown by lines —geodetic items, for example, an equator; or anything which is placed in close conjunction with a line, so it can not possibly be confused with anything else. But when you have a thing like this, or this, or this (indicating on board) as part of your type faces, this is bad, just plain bad. Because, what is it? Is this an air strip, or is it an old factory? Is this a fort or a paper-making mill? What is this? Is this an air strip or is it a letter? You can not tell.

Where you have letter spacing, there is a strong element of confusion. It might be a piece of abandoned railroad or some other type of culture.

The minute you put that serif on you know that's the letter "i," you are not going to confuse it with anything else. I think the best thing that could happen in this town would be for every single sans-serif type face to be thrown out tomorrow, never to appear again.

It is a funny thing, you know, these things seem to appeal to military people and civil engineers. They look neat. Of course they look neat, but they are absoltuely no good for the purposes of cartography. If I want to make one point today, this is the point I want to make most strongly: get rid of that sans-serif type.

Well, let's see. Do we have anything else or should we leave on this cheerful note? Let's turn the meeting over to questions, and don't let them get away without asking questions this time, because my bitterest disappointment in Washington, D. C., was six years ago at the Society for Photogrammetry, where I took part in a symposium and had a nice hot speech, and when the chairman said "Are there any questions?" of course, as always, there was dead silence for about 30 or 40 seconds. He then said, "All right, if there are no questions I will turn the meeting over to the president." The president adjourned the meeting and that was that.

MR. LAW: We'll see if we can do a little better. Did someone have a question?

MR. HARRISON: I'll ask a question myself.

MR. QUAM: It seems to me that one of the effects that some of the European maps obtain, particularly the Swiss maps, is by the use of light as well as shade, and we seem to emphasize the shade. Isn't that yellow plate the Swiss use a very important part?

MR. HARRISON: Good question. I am glad you asked that because I meant to go into that.

It does not have to be a yellow plate. As I have been trying to tell Charlie Fuechsel and the boys down there, they can save a plate, lots of expense, and a lot of trouble by using the white paper as a plate. All you have to do is to make a chiaroscuro drawing instead of starting with a white piece of paper and rendering in dark on the white. You start with a median tone just like in the Tanaka paper. You all read that in *Geographical Review* about 8 years ago. Wasn't it 8 years? You start with a median shade of gray, you render your shadows in dark and you render the lights with an erasing machine, a knife or what-have-you. The yellow is a nice touch. It adds a warmth to the map, but it is totally unnecessary. You just use the white paper for your light side. I think the Swiss are just trying to sell another plate.

A VOICE: Professor Imhof has done the large school chart of the Canton Aargau in south lighting because the school officials said all their vineyards and everything are on the south. Nothing reverses.

Don't you think that, if a cartographer-landscape artist like Imhof does this kind of shading, it can be done with south lighting?

MR. HARRISON: It can be done.

Somebody during the war made a drawing of Central Germany and Czechoslovakia which had south-lighted hill-shading. And it doesn't reverse too much. But, nevertheless, the map is not as satisfactory as it is when you turn it upside down.

This last time I went out to St. Louis I took a drawing I had made of Africa, and the thing that amazed them was that it did not reverse. This is probably because in the process of making such a drawing I violated the rules of strict shades and shadows constantly. You are forced to do this. Many of you may have noticed that if you make a model—it can be the best model in the world—it is almost impossible to light it so that all features are shown equally well. Supposing you have a light source here and an escarpment running across the light. Well, that's duck soup, it shows up beautifully. But if the escarpment runs in the direction of the light, it is not so easy. But if you take liberties with the light source, you can produce a drawing which will not reverse. But I still like my south at the top.

MR. BELLAMY: When you look at a map that's converging this way, that doesn't hit into your eye.

MR. HARRISON: Diverging instead of converging?

MR. BELLAMY: Well, that puts your south—

MR. HARRISON: I don't know. I don't think that that makes so much difference.

MR. BELLAMY: If you look at a map, I think that you ought to look at it the way you say.

MR. HARRISON: Actually, you know, the north-at-the-top concept is a comparatively recent one. This may surprise some of you, but two or three hundred years ago it was very common to have any orientation. I have a copy of a map of Ireland, made by none other than Mercator, with west at the top. I have another very ancient drawing of the Bible lands with southeast at the top.

But the advent of adjoining survey sheets is really the thing that has made it requisite to establish a normal top and bottom to maps. Otherwise, the sheets do not fit. But if you have a whole hemisphere done that way, you have obviated the problem, it seems to me.

A VOICE: Sir, I understand that in design of maps you suggest that maps go out of the control of the cartographer and into the hands of the engineer.

If that is so, can you suggest any way in which the cartographer can once more gain the proper control of the maps which he is producing, the design of maps?

MR. HARRISON: That is a good question. I wish I knew the answer. I will bet there are a lot of people in the room that would like an answer. Would anybody volunteer an answer? Is Charlie Fuechsel here or has he given up long ago?

MR. LAW: That is one question we can't answer. Any more questions?

A VOICE: Can I make one suggestion? How about giving the engineer a little more of the artistic?

MR. HARRISON: Just as good, just as good. Make an artist out of the engineer. It is possible?

A VOICE: In answer to the cartographer who just asked the question, perhaps we can use the old saying: "The squeaky axle gets the grease." If he wants a little more control over his mapmaking and if he knows something that is being put on that map or something that is done to that map that hurts his artistic feeling, he should holler about it and maybe he will be heard, if he has a good enough case.

MR. HARRISON: I tried to emphasize in my talk, perhaps a little indirectly, that the engineer is absolutely essential and the artist is absolutely essential. There has to be a little better division of function and a little greater allotment of function to the artist.

Now, I think that, when all the preliminary work is prepared and the compilation is ready, the matter is then in the realm of the graphic arts, converting that material to a drawing which can go right through the engraving and printing processes and result in a map which has the effect that we all want.

You see, there are a lot of mysteries involved here, like type, line work, and a simple technological approach is not enough. If I haven't made myself clear on this point I might as well have stayed in New York.

A VOICE: Many of these charts produced by the military agencies must be used under a red light and the tremendous effect that has on the colors.

MR. HARRISON: Yes. Well, of course, anything which has a very special requirement like that just has to meet that requirement, that is all there is to it, but in the process of producing that map just acquaint the artist-cartographer with your requirements, and he might even be able to produce that kind of a map better.

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Electronic Computers Are Idiots

By W. A. ANGELONI

CHAIRMAN, NORTHERN CALIFORNIA SECTION, ACSM

ALL OF US have heard the words "Electronic Brain" associated with electronic computers. We have seen how they are utilized on television programs to bring together compatible couples, select the questions for high priced quiz programs, prediction of election results, etc. In most instances, this is showmanship at its greatest; actually these so-called brains are *idiots*. The machines will only do what they are instructed to do, period. No more or no less.

To demonstrate this point, let us assume that we wish to multiply the number 2 by 3. You may think this is not a fair test for this equipment. Hovewer, the procedure and time required to accomplish this is the same as would be required to multiply two numbers in the billions.

We know what we want to do and we have a room full of equipment to do it with, so how do we start?

First of all we have to get these numbers we wish to multiply into this monster. In order to do this, we must develop a set of instructions which is called a *program*. For this purpose, we will assume that we are using a monster with *drum storage*. This is a machine that has a rotating drum on which we can place data and obtain it from the drum when required. In this instance, we wish to multiply 2 by 3, so we will store these numbers until we are ready to use them. We must designate the *locations* in which we store the numbers, which will be referred to as their *addresses*. Let us assume we have a computer that has 2,000 storage locations, so let us arbitrarily pick address location 0101 to store the number 2, and 0102 to store the number 3. We can now proceed to punch cards for our data and then place them in the data-input bin of the machine. The data will be read from the cards and stored in locations 0101 and 0102 as designated.

The machine still does not know what to do with the data, so the program will have to be completed, and this is actually the operational part of the program. The instructions are written in a *language* the machine understands. It is called the *operational code* and consists of numbers or letters that designate specific operations to be accomplished. This machine language is different for each machine, but following is a typical set of instructions:

Location of Instruction	*Operation Code*	*Data*	*Next Instruction*
0001	65 (RAU)	0101	0002
0002	19 (MULT)	0102	0003
0003	20 (STL)	0027	0004
0004	71 (PCH)	—	—

First Line

The first column indicates the location of the first instruction, which is arbitrarily selected in this instance. The second column has an operation command 65, which tells the machine to reset the accumulator to zero and place the contents of the address 0101 given in the next column in the upper part of the *accumulator*. The accumulator is the arithmetic unit of the machine and is comparable to the carriage of a desk calculator. The multiplicand is always placed in the upper part of the accumulator. The machine was designed in this manner. The product of a multiplication will always go into the lower part of the accumulator, just as it might in a desk calculator. The last column tells the machine where to go for its next instruction, which is 0002 on the second line.

Second Line

The second column in the second line lists the operation code as 19, which tells the machine to multiply the contents of the accumulator by the number given in the data address, which is 0102, in which we stored our number 3. So we now have

achieved what we started out to do. We have a product and it is in the lower accumulator. The last column tells the machine to go to 0003 for its next instruction.

Third Line

This line will tell the machine what is to be done with the product. The instruction, code 20, tells the machine to store the contents of the lower accumulator in storage location 0027, which is in a zone designated on the storage drum from which we can obtain data to punch out on cards, and the last column tells the machine to go to location 0004 for its next instruction.

Fourth Line

The second column lists an operation code, 71, which simply tells the machine to punch the contents of address 0027 on a card. So our final output from the machine is a card punched with our answer. The punched card is then placed in a printer, which is a device which reads the card and types out its contents on a sheet of paper. The printer is an auxiliary piece of equipment that is referred to as *hardware*.

In solving this sample problem, we have covered the basic components of all computers which, in review, are as follows:

1. Program—Instructions for computer.
2. Input—Data and instructions into computer.
3. Memory or Storage—Ability to place data in computer to be used as needed.
4. Arithmetic Unit—Referred to as the accumulator in most computers which have ability to perform arithmetic computations.
5. Output—Final results from computer.
6. Hardware—Auxiliary equipment such as printer or additional storage units, such as magnetic tape, etc.

One very important feature of the machine that was not involved in our problem, but is undoubtedly the reason why these computers are called "brains," is the fact that they can make programed decisions. The machine has the ability to make a *yes* or *no* decision, which is referred to as a *branching operation*. In effect, the programer has prepared a set of instructions which tells the machine that if one condition exists, perform certain instructions; or if another condition exists, another set of instructions shall be performed.

For example, in a payroll problem there may be a limitation on the weekly earnings of an employee. The program would then be arranged so that each time a gross earning is computed for an individual the machine would determine if the established limit was exceeded; if not, it would continue in the normal execution of the program. If the limitation was exceeded, it would then branch and execute another set of commands. This would be accomplished in the computer by writing the program so that each time a multiplication is made to determine gross weekly earnings, the result is subtracted from the maximum allowable figure (stored in the machine) and, if the subtraction results in a positive number, the machine will proceed with its normal program, but if the result is negative it will branch and perform other instructions indicating that the maximum was exceeded.

I am certain by this time that you are all convinced that this machine does nothing unless it is given explicit instructions, and I hope that I have been able to prove my point—that the machine is not the brain it is given credit for being. However, if you are wondering by this time why anyone would invest a quarter of a million dollars or more to construct an electronic idiot, let me point out how fast this computer works. The following times for performing operations are for a medium sized computer. There are machines that are much faster and, of course, smaller computers that are slower:

78,000 additions or subtractions per minute.

5,000 (10 digit $\times$ 10 digit) multiplications per minute.

3,700 (20 digit $\div$ 10 digit) divisions per minute.

138,000 logical decisions per minute.

When one stops to realize that in the time it takes to blink an eyelid, this machine can make hundreds of computations and has the ability to let us know that John Doe's salary for a pay period exceeds the allow-

able maximum, it is no wonder that these computers are called electronic brains, but the machine has not been constructed that will actually take the place of the human brain—a device that has unlimited storage capacity and the ability to conceive a problem and work out a solution without instructions.

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In general, each quadrangle map of this series will cover one degree of latitude and two degrees of longitude. Villages, towns, roads, railroads, and other important cultural features are shown, as well as the names and general character of the principal topographic and hydrographic features. The contour interval used will vary from 50 to 500 feet depending upon terrain and the source data available.

The maps are printed in five colors, with cultural features in black. Railroads are symbolized according to gauge and number of tracks. Roads are classified by symbols and red fill to indicate surface and number of lanes. International, State, county, and government-reservation boundaries are shown. The population of towns and cities is indicated by variations in the size of type for place names.

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Some Applications of Electronic Computers to Surveying Problems

By C. J. MONTGOMERY

DIVISION CIVIL ENGINEER, TIDEWATER OIL COMPANY

ONE OF THE longest forward steps in mathematical progress since the invention of the mechanical adding machine has been the development of electronic computers. By their versatility, their enormous capacity for work, and their sheer speed, these computers are producing a tremendous impact on the work of all those who use mathematics. It has been pointed out that, while accountants, statisticians, and research scientists have been in the forefront of the development and use of computing equipment, engineers have been slow to take advantage of electronic computers.[2]

There has been a great deal of publicity concerning these new mathematical tools, and the tendency has been to term them "Electronic Brains." Nothing could be farther from the truth, and their manufacturers would be the first to agree that the computers "are in reality high speed morons."[2] Be that as it may, in spite of their inability to think, the computers lend themselves to the performance of countless engineering tasks that serve to take the load of tedious, repetitious, mathematical drudgery from the shoulders of the engineer or surveyor. The use of computers will enable the engineer to devote more of his time to true engineering problems and may well be the answer to the shortage of engineer personnel.

Examples of the type of problem which can be solved may be found in highway earthwork computation, survey traverses, survey area computation, highway geometrics, stress analysis, hydraulics, traffic analysis, and many other fields, even translation of languages.

This is not intended in any sense to be a paper on the technical aspects of electronic computers, but rather a general discussion, intended as an introduction, to acquaint those who have not yet had the opportunity to make use of these extremely useful tools with some of their applications. In order to do this, a brief discussion of computers and elementary principles of their operation is necessary.

In general, the electronic computers are divided into two types; namely, analog and digital computers. These two types might best be represented by the slide rule or planimeter (analog) and the adding machine (digital). All three are computers and it is possible to solve problems with any one. In the former, values are represented by a process of measurement which results in an accuracy of only a few significant figures; in the latter, values are represented by reference to countable physical things, like the teeth of a gear or the steps in a ratchet.[3] In this discussion we will consider only the digital electronic computer.

In solving a problem by means of any computing device, five elements are required. They are: data, instructions, memory, the computing device, and a means of preserving the result of the computation.

In performing an operation with a desk calculator these elements would be represented by the paper containing the numerical data to be operated upon, a mathematical formula to be followed (either written on paper or in the calculator operator's

[1] McNair, Arthur J.: Electronic Computers in Surveying Operations. *A.S.C.E. Proceedings.* Paper 1444, p. 1.

[2] Editorial: Brain is the Wrong Word. *Engineering News-Record,* Nov. 26, 1957, Vol. 159, p. 88.

[3] Stibitz, G. R. & Larrivee, J. A., Mathematics and Computers, *McGraw-Hill Book Co., Inc.,* New York, 1957. p. 45.

mind), the memory of the calculator operator, and the desk calculator itself. The operator's pencil and the paper would record the result.

The same elements are required in an electronic computer. The data are supplied in a language the machine understands, either on magnetic tape, punched tape, or punched cards. The instructions are very exact and are introduced into the machine by the same means as the data. The memory generally consists of a revolving magnetic drum, magnetic cores, or magnetic tape on which data in the form of digits are stored. The computing device is electronic, located within the machine. It is capable, among other things, of addition, subtraction, multiplication, division, and logical testing.

In operation a set of instructions, called a program, is fed into the ocmputer's memory by means of magnetic tape, punched tape, or punched cards. Next, the data are fed into the computer's memory by the same means, the necessary arithmetical operations are performed, and the results emitted from the computer by the same means the data were introduced. This tape or card answer information is then run through a machine that translates the magnetized or punched tape or cards into readable information. In some computers a typewriter-like machine is used for input and output of data.

Faced with an ever increasing volume of computations concerning survey work, our engineering department decided to investigate the possibilities of using electronic computers. We discovered that there were some survey traverse programs readily available at a local branch of a computing service bureau. A study of these existing programs, which use bearings and distances as input data, led us to believe that, for our particular use, a program could be evolved which used angles and distances as input data, thus saving the computation of bearings from angles. Our survey procedure consists of the running of random traverse lines from which we locate each bit of information that could possibly influence the determination of a property line. This results in a tremendous number of required computations. These ties are generally in the form of angles and distances from the survey stations which we term "hubs." The ties themselves are known to us as "side shots." We hoped to be able to include the computation of the coordinates of the side shots in the proposed program.

With the aid of one of our engineers who was familiar with our problems and with computers, the service bureau's mathematicians provided us with programs which will perform the following operations with a closed traverse.

SURVEY TRAVERSE PROGRAM

Having as known quantities the plane coordinates of the initial point of the survey and the bearing of the first line of the traverse, and entering as data the angles turned clockwise from the previous hub to the next hub and to all side shots, together with the distances to those points, this program will:

(1) Check the traverse for geometric closure,

(2) Adjust the angular error in each angle inversely proportional to the sum of the squares of the sides forming the angle,

(3) Compute adjusted bearings for each line and the bearing to each side shot,

(4) Compute a trial closure which is adjusted by Crandall's method and recomputed as final, and

(5) Compute plane coordinates for each hub and side shot.

The methods of adjustment in (2) and (4) above are the type we believe most nearly meet the requirements for our work. Others may prefer the Compass Rule or Transit Rule for adjustment.

ACREAGE COMPUTATION PROGRAM

Having obtained the coordinates of all the points located in the field survey, that information is carefully edited and points selected for use in determining boundaries. Many times it may be necessary to project fencelines or lines of marked trees to intersection, etc., in order to determine the coordinates of a property corner.

Having as known quantities the coordinate values of all property corners or the

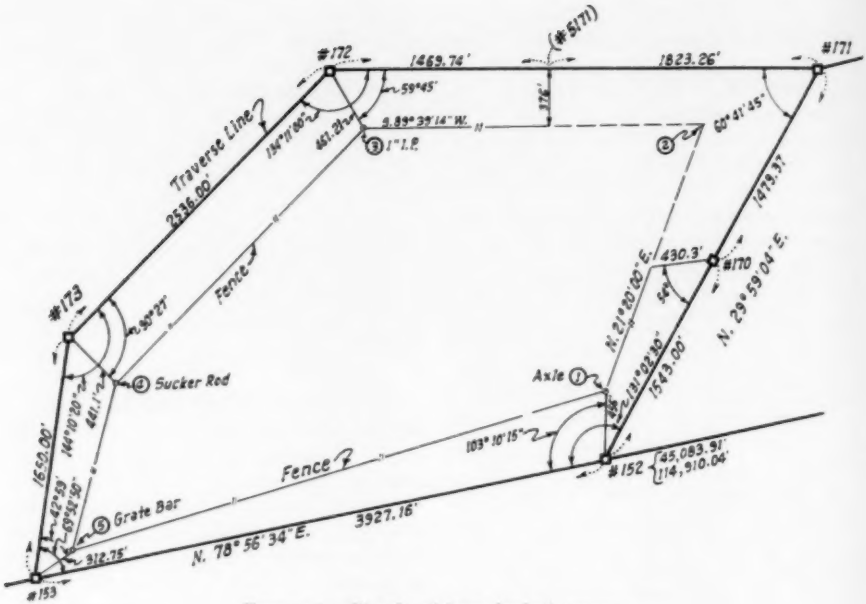

FIGURE 1.—Sketch of hypothetical traverse.

coordinates of alternate corners and knowing the bearings of the lines interesecting at the unknown corners in a closed figure, this program will:

(1) Solve for the bearings and lengths between the corners,

(2) If a corner is unknown, solve the intersection and compute the coordinates of the unknown corner, and

(3) Compute the area enclosed by the figure.

An application of these programs is illustrated by the following example. A sketch of a hypothetical traverse surrounding a tract of land on which we wish to determine the corner coordinates and area is shown in Figure 1.[4] The hubs are indicated by squares and numbered 152, 153, 170, 171, 172, and 173. For our problems we will assume that the line between Hubs 152 and 153 has been previously run and its bearing determined. The coordinates of Hub 152 have also been determined. We also assume that the line between Hubs 152 and 170 has been previously run; its bearing, which we wish to preserve, has been determined as well as its length, which we also wish to preserve. Now, that means that we wish to preserve the angle between the traverse lines which converge at Hub 152 as well as preserve the length of the line between Hubs 152 and 170.

Note the form illustrated by Figure 2. We have the necessary data to fill out the introductory information at the top of the form. Date, authorization, and job are self-explanatory and for purposes of identification only, as are "Field No." which we will call 777 and "Closure No." which we will call 99. Since we wish to preserve the length of the line between Hubs 152 and 170 and, with this program, we can hold the value of only the first line of the traverse, we will begin at Hub 152. Also to preserve the previously obtained bearing of the same line we must hold the value of the angle turned at Hub 152. We have previously made the necessary computation and have for the bearing of the first line of

[4] Sketches and examples from a talk given by Robert E. Crosser at the 27th meeting of the Texas Section, A.C.S.M., September 27. 1957.

ELECTRONIC COMPUTER FORM FOR
TIDEWATER SURVEY TRAVERSE

DATE 12-1-57 AUTHORIZED BY C.J.M. JOB NO. 700

FIELD NO. 777 (XXX) CLOSURE NO. 99 (XX)

BEARING FIRST LINE N. 29°59' 04" E. (X XX XX XX X) COORDINATES FIRST STA. 45083.91 (XXXXXXX.XX) 114910.04 (XXXXXXX.XX)

FIRST SIDE IS FIXED ~~UNFIXED~~. TRAVERSE IS ~~CLOCKWISE~~ COUNTER CLOCKWISE.

HUBS XXXX	SS XX	ANGLES CL XXX XX XX	LENGTH XXXXXXX XX
0152	00	- 131 02 30	1543.00
0152	01	103 10 15	456.00
0170	00	180 00 00	1479.37
0170	01	054 00 00	430.30
0171	00	060 41 45	1823.26
5171	00	180 00 00	1469.74
5171	01	090 00 00	376.00
0172	00	134 11 00	2536.00
0172	01	059 45 00	461.21
0173	00	144 10 00	1650.00
0173	01	090 27 00	441.10
0153	00	069 52 50	3927.16
0153	01	042 59 00	312.75

X's indicate number of digits to be used.

FIGURE 2.—Electronic computer form for traverse data.

the traverse N. 29° 59′ 04″ E. which we enter on the form. The coordinates of the first station are indicated on the sketch and we enter them in the space provided. Our particular custom provides for the *Y* value to be placed first in a sequence or above the *X* value when entered with one value above the other. As already noted, we wish to preserve the length of the first side so we mark through the word "unfixed." By observation you will note the traverse is to proceed in a counterclockwise direction so we mark through the word "clockwise." These items take care of the introductory information which is used for a lead card for the data which tells the computer what it should do with the information it receives. I might add here that, for this class of work, we do not ordinarily use seconds of arc but they are used here for the purpose of demonstration.

We proceed next to the detailed data shown in Fig. 2. Beginning at Hub 152, we enter its number in the first column observing the required number of digits by a leading zero. Since the angle we will use as the next bit of data is that to a succeeding hub rather than to a side shot, we enter "00" in the "SS" column. In the next column, wherein are listed angles turned clockwise from the backsight, we enter 131° 02′ 30″, the negative sign indicating that we wish this angle to be preserved without adjustment. The length we enter in the last column, already having indicated in the introductory data that it is to be preserved.

While our instrument was located at Hub 152 we turned an angle and measured a distance to an axle which represents one of the corners of our tract of land. This information we now enter on the second line of the form, repeating the hub number. This is a side shot and the first one from this station; so, in the following column, we enter the figures "01." Successive side shots would be numbered "02," "03," etc. The angle turned to this axle is 103° 10′ 15″ and the distance to it is 456 feet. These values are entered in the next two columns.

Now we proceed to the next Hub, 170. The sketch does not so indicate, but this point was a P. O. T. We enter the hub number, the angle to the next hub, which is 180° 00′ 00″, and the length. Note here that points on line from which right angle ties are made can be entered and used if such points are considered as hubs and assigned an identifying number, such as adding a 5 or other digit in the thousands place of the number of the previous hub. For example, see Hub 5171 in Figure 2. The

FLD	SR	HUBS	SS	ANGLES CL	BEARINGS	LENGTH
777	99	0000		0.0319444-		
777	99	0000		0.0037617-		
777	99	0000		0.0004430-		
777	99	0000		0.0000523-		
777	99	0000				
777	99	0152	00	131 02 30	N 29 59 04 E	1543.00
777	99	0152	01	103 10 15	N 02 06 49 E	456.00
777	99	0170	00	180 00 00	N 29 59 04 E	1485.12
777	99	0170	01	054 00 00	S 83 59 04 W	430.30
777	99	0171	00	060 42 03	N 89 18 53 W	1832.65
777	99	5171	00	180 00 00	N 89 18 53 W	1477.31
777	99	5171	01	090 00 00	S 00 41 07 W	376.00
777	99	0172	00	134 11 22	S 44 52 28 W	2531.74
777	99	0172	01	059 45 00	S 29 33 53 E	461.21
777	99	0173	00	144 10 42	S 09 03 10 W	1639.24
777	99	0173	01	090 27 00	S 44 40 32 E	441.10
777	99	0153	00	069 53 24	N 78 56 34 E	3913.23
777	99	0153	01	042 59 00	N 52 02 10 E	312.75

FIGURE 3.—Printout

program is so written that it will not adjust angles which are exactly 180° to avoid having a series of small deflections in a tangent line on which many side ties are made. At Hub 170 we turned an angle and measured a distance to a post in a fence forming the western boundary of our tract.

We proceed to Hub 171 where we were not able to make a tie to the northeast corner of our tract, but continue to a point on tangent at 18 plus 23.26 where we make a right angle tie to the fence as described in the preceding paragraph.

We continue around our traverse in a like manner, noting the data as illustrated above. When the data are completed, they are given to a key punch operator who punches the data on cards. The cards are then processed through an interpretative printing machine and the tabulated results used for checking purposes, to insure that the proper data were punched in the cards.

Now we are ready for the computer to begin its work. The cards containing the "program," or detailed instructions, are fed into the computer, followed by the cards containing the data. The computer begins to perform its operations. It is quite an impressive sight, with well over a hundred tiny, flickering lights and metallic crunching sounds, as the computer finds an answer and punches it in an answer card.

The answer cards are removed from the computer and processed through the interpretative printing machine. The results are shown in Figure 3. I might say here that intentional angular and linear errors were introduced to better illustrate the adjustment feature of this program. The four numbers listed at the top of the column, "ANGLES CL," are the results of successive iterations of the computer in adjusting the angular error. The first of these figures is the initial error expressed in decimal parts of a degree. The first figures listed under the columns marked "LAT" and "DEP" (16.164– and 23.055) are the initial errors of closure and their signs.

The adjusted values of the angles are found in the remainder of the columns, as are the adjusted bearings (note that by holding the value of the first angle we have preserved the first and last bearings), the adjusted distances (note that the first distance is preserved), the adjusted values of the latitudes and departures of the main traverse, and the adjusted values of the coordinates of both hubs and side shots.

There is one feature that is apt to be con-

LAT	DEP	TOTAL LAT	TOTAL DEP	
				ERROR ANGLE
				ERROR ANGLE
				ERROR ANGLE
				ERROR ANGLE
16.164-	23.055			ERROR SIDES
1336.487	771.137	46420.40	115681.18	
		45539.60	114926.86	
1286.357	742.212	47706.75	116423.39	
		46375.30	115253.25	
21.916	1832.520-	47728.67	114590.87	
17.666	1477.204-	47746.34	113113.67	
		47352.70	114586.37	
1794.124-	1786.285-	45952.21	111327.38	
		47345.18	113341.23	
1618.818-	257.925-	44333.39	111069.46	
		45638.55	111637.51	
750.516	3840.586	45083.91	114910.04	
		44525.79	111316.03	

of final survey data.

fusing here. The coordinate value opposite a hub is actually the coordinate of the next successive hub, while the coordinate opposite the listing of a side shot is the coordinate of that side shot.

Having the coordinates of all of the points we located in our field survey, we can now proceed to determine the bearings and lengths of the lines enclosing our tract of land and its area. To use the area calculation program we need either coordinates or bearing of lines. Three types of input cards are utilized and we must indicate the card type on the form illustrated in Fig. 4. Type 1 cards contain only coordinate values. Type 2 cards contain only bearings. Type 3 cards contain both bearings and coordinate values.

From the data produced by the computer and shown in Fig. 3, we find that the coordinates of the axle tied in from Hub 152 to be $Y = 45{,}539.60$ and $X = 114{,}926.86$. We will use this as our initial point. This requires a Type 1 card, and we enter these data on line 1, calling the axle Corner No. 1. By inverse computation with a desk calculator we determine that the bearing from the axle through the fence tied in at Hub 170 to be N. 21° 20′ 00″ E. This requires a Type 2 card and we enter this bearing on line 2, calling the unknown corner, Corner No. 2. We make another inverse calculation between the fence tied in from Hub 5171 on the north line of the tract and the 1″ iron pipe at the northwest corner. We find this bearing to be S. 89° 39′ 14″ W.,

TIDEWATER AREA CALCULATIONS

DATE: 12-2-57 AUTHORIZED BY C. J. M. JOB NO. 700

FIELD NO. 777/XXX TRACT 33/XX

T X	CORNER XXXX	BEARING Y XX XX XX X	TOTAL LATITUDE XXXXXXX.XX	TOTAL DEPARTURE XXXXXXX.XX
1	0001		45 539.60	114 926.86
2	0002	N. 21° 20′ 00″ E.		
3	0003	S. 89° 39′ 14″ W.	47 345.18	113 341.23
1	0004		45 638.55	111 637.51
1	0005		44 525.79	111 316.03

FIGURE 4.—Electronic computer form for area data.

FLD	SR	HUBS	SS	ANGLES	CL	BEARINGS	LENGTH
777	33	0001	00	000 00 00		N 74 19 01 E	3750.45
777	33	0002	00	000 00 00		N 21 20 00 E	1953.26
777	33	0003	00	000 00 00		S 89 39 17 W	2296.25
777	33	0004	00	000 00 00		S 44 57 04 W	2411.48
777	33	0005	00	000 00 00		S 16 06 51 W	1158.27
777	33	0000	00	000 00 00			

FIGURE 5.—Printout

and it takes us to the 1″ iron pipe whose coordinates we know from Figure 3, and which we will call Corner No. 3. This combination of bearing plus coordinates requires a type 3 card. Incidentally, a type 2 card must always be followed by either a Type 3 or a Type 1 card. We next proceed to the sucker rod, calling it Corner No. 4 and entering its coordinates; likewise with the grate bar at the southwest corner, which we will call Corner No. 5.

The data thus prepared are again given to a key punch operator who punches the information into cards according to the instructions pertaining to the area computation program. Again the program is fed into the computer, followed by the data cards, and the computer begins its work.

The results of this computation are shown in Figure 5. The computer begins to work and finds it has an intersection to solve in order to obtain the coordinates of corner No. 3. It makes that solution, prints out the bearing and length of each side of the tract, and ends with its area expressed in acres, which is printed at the end of the "DEP" column.

This example represents an application of the electronic computer to some of our everyday routine work. As previously pointed out, we discovered years ago that, for us, the most economical method of conducting a survey was to run random traverses and make accurate ties to every bit of information that could possibly influence a property line, then proceed to compute the

High School Students to Study Surveying

The following is quoted from the *Journal, Florida Engineering Society*, December 1958, Vol. XII, No. 4, page 41, to show what is being done in one locality to guide promising youngsters into the engineering-and-surveying field.

—EDITOR

"Twelve Dade County high school seniors with aptitude in mathematics will have a chance to get an early start in engineering education next year.

"Cooperating with the University of Miami's School of Engineering, four engineer and contractor groups will sponsor 12 scholarships for a special course in surveying, beginning in the spring.

"Cosponsors with UM are the Miami chapters of the American Society of Civil Engineers and the Florida Engineering Society, the South Florida chapter of Associated General Contractors of America and the Engineering Contractors Association of Dade County. Dr. Murray I. Mantell, chairman of the university's civil engineering department, is administrator of the program.

"Purpose is to interest superior high school students in civil engineering and construction. Applicants selected by each school's scholarship committee are finally chosen after being interviewed by a committee of the sponsoring groups.

"The course will start Feb. 11 and continue through UM's second semester, paralleling the final half of the senior high school year. Classes will meet Wednesday evenings and Saturday mornings.

"Next summer the scholarship students will be offered jobs by members of the sponsoring organizations to work in the field. They will be encouraged to continue engineering studies in college."

LAT	DEP	TOTAL LAT	TOTAL DEP	
1013.810	361 830	45539.60	114926.86	
1819.420	71 580	47359.02	115637.44	
13.840-	2296.210-	47345.18	113341.23	
1706.630-	1703.720-	45638.55	111637.51	
1112.760-	321.480-	44525.79	111316.03	
	156.591			AREA

of area computation.

coordinates of all of this volume of data for ready use. This computer program fits our needs remarkably well and we are convinced that we are saving money by utilizing it. With a sufficient volume of work to exceed the minimum charge of the service bureau, which performs this work for us, the survey traverse program costs approximately 15 cents per line of data. The area computation cost runs about the same in volume quantities, but, except in unusual cases, the minimum charge is rarely exceeded.

We have found the area computation most advantageous in computing the area of tracts within large gas production units, many of which are 640 acres in area, irregular in shape, and composed of hundreds of small tracts. These require many bearing intersection solutions, as well as area computations. On recent work we carefully tabulated the cost of computer computation as against manual computation of the identical work and found that the cost by electronic computer was 56 percent of that of manual computation.

In closing, I want to re-emphasize that the electronic computer is not a genius. It cannot give good results from imperfect or incomplete data. In fact, I can think of no other field in which more care and checking are required than in the preparation of data for use in the computer. However, given carefully prepared data, it can do an astounding amount of work in an incredibly short time.

New School for Nova Scotia Land Survey Institute

A new school, built for the Nova Scotia Land Survey Institute and situated in Lawrencetown, Annapolis County, Nova Scotia, was officially opened with ceremonies on October 29, 1958. The school, founded thirteen years ago by Major J. A. H. Church, has been extended and assisted by funds bequeathed for founding and maintaining a vocational school in the Annapolis Valley by the late Dr. J. Hall, a distinguished educator and native of the area. The land on which the school was built was donated by the Lawrencetown Branch of the Canadian Legion.

Present courses extend surveying training to a two-year course, and courses in cartographic drafting and photogrammetry have been added. It is hoped to develop in the near future degree courses in surveying.

Imago Mundi

Word has been received of the appointment, as Editor of *Imago Mundi,* of Captain E. Roukema, Calle Manuel Borobia, Portals Nous, Mallorca, Spain. Captain Roukema succeeds the late Dr. Leo Bagrow who guided *Imago Mundi* through fourteen volumes, beginning with the first issue, published in 1935.

Imago Mundi, an annual serial publication, features articles, reports, and reviews in the field of historical cartography.

—Walter W. Ristow

Library of Congress

The Use of the Tellurometer for Photogrammetric Mapping

By WILLIAM O. BAKER

MICHAEL BAKER, JR., INC.

MY DISCUSSION of the Tellurometer will deal mainly with the results we have obtained over the past several months in using this equipment for control of highway surveys and photogrammetric mapping.

First, I would like to point out our reasons for ordering this equipment as soon as it became available on the American market.

During the past few years photogrammetric maps have become more widely used and generally accepted as the most economical method for preliminary location of highways. Since the Federal Aid Highway Act was passed in 1956, the use of photogrammetric surveys has been increased to include final design and in some cases the determination of final earthwork quantities. When these maps started to be used for final design, it became necessary that all features be shown accurately, within reasonable limits; not because it made any great difference whether the final highway as built is coordinated within first-order accuracy, but because various highway engineers must design partial sections of a complete interstate route, and these sections must, in turn, tie together when the field stakeout for construction is performed.

In many States existing Coast and Geodetic Survey control monuments are spaced twenty to thirty miles apart along a particular highway route. With the old standards of third-order surveys, requiring a horizontal closure of one part in five thousand, it was entirely possible that an actual error of closure of thiry feet could be adjusted, and, in practice, a much larger error than this might exist along the third-order traverse. Naturally the photogrammetric maps are no better than the ground control on which they are based, and, since the interstate highway system must be referenced to the various State coordinate systems, a displacement of existing features, either planimetric or topographic, by thirty feet would make the map inadequate for highway design.

Since the purchase of the Tellurometer equipment, we have used it for control surveys on all major highway projects. I would like to cite in detail a few specific jobs, the problems encountered, and the final results.

On Ohio Route 46, south of Ashtabula, one of the first projects where the Tellurometer was assigned, it was decided to establish all horizontal, picture-point control required for two-foot-contour maps at a scale of 1:600, to give the field party experience and to gain knowledge of our costs by this method. A triangulation network was established along the six-mile route and tied to government control monuments at the north and south ends. Distances were measured by using the Tellurometer and most of the angles were measured with a Kern one-second theodolite. On this first job a few of the triangulation points were poorly chosen and inaccurate distances resulted from interference of water tanks and other similar structures close to the lines between stations. It was necessary to relocate these points so that good clear signals could be obtained on all readings. The distances measured ranged from 700 feet to 3,000 feet and were too short in some cases to gain the advantage of the microwave system. However, a final closure of one part in 26,000 was obtained on the control survey. The major portion of the final ap-

Presented at the Eighteenth Annual Meeting, American Congress on Surveying and Mapping, Washington, D. C., March 24–26, 1958.

proved centerline has now been staked in the field and a profile run by field methods. The largest error so far encountered amounted to 0.4 foot vertically, which is only 20 per cent of the allowable error under standard mapping specifications.

The Tellurometer was not designed or intended to be used for short distances, and control for the next highway project, Route 28, from Aspinwall to Kittanning, Pennsylvania, was laid out in a manner which we feel is most economical. This highway will parallel the Allegheny River for a distance of 45 miles along a route where the relief is approximately 500 feet. A triangulation network was established so that one line would follow fairly close to the proposed centerline, like a traverse, and the other sides of the triangulation system formed quadrilaterals a mile or two back from the centerline. Again, a one-second theodolite was used to measure all angles and also to triangulate to the additional picture-point control required. The average length of the lines measured was two miles, with a maximum of five miles. The relative closure of each quadrilateral was computed, with the following results: 1:62,000; 1:88,000; 1:38,000; 1:98,000; 1:32,000; 1:52,000; and 1:29,000. This was the type of horizontal closure we were hoping for and what we felt was needed to satisfy the requirements of the highway designer. This limits the maximum horizontal displacement of a control point from true coordinate position to approximately two feet, even on the long lines previously mentioned where Coast and Geodetic control does not exist.

An interesting application of the microwave system was the verification of a base line for construction of the Fort Pitt Tunnel in Pittsburgh. Original surveys by the State Department had been performed using high towers erected on top of Mt. Washington, a built-up area of the city. These towers had been removed and would have been costly to replace. A triangulation system was established, using control points at the tops of hills beyond each end of the tunnel. Readings were taken to these control points and then to the original base line at each portal. Results checked within 0.08 foot over a total distance of 37,200 feet, or a closure of 1:465,000. All the field work was completed in two working days.

The Tellurometer was used recently on a similar project to establish a base line for the construction of Beaver County Bridge No. 1, over the Ohio River, between Monaca and East Rochester, Pennsylvania, with similar results.

An additional Tellurometer unit is being used to establish control for mapping in western United States. These maps are the new 1:250,000 series produced by Army Map Service and compiled by stereo methods. The control for this type of mapping need only be spaced every ten to twenty miles or more. During the past five years we have completed the mapping of over 160,000 square miles for the United States Government and it is now apparent how much time could have been saved, with increased accuracy, if these Tellurometer units had been available.

I have tried to give a true picture of our experience so far, but have not mentioned some of the problems encountered while using the equipment:

1. The sites must be carefully selected, so that there is no interference either along the line or from back reflections.

2. A crew will require training for approximately three months before they can detect all the things that may cause interference and thus perform a maximum amount of work.

3. Because the sites are of necessity usually some distance from a road, the transportation of equipment and batteries can become a problem.

4. The maintenance work on our equipment has been minor, but this could be troublesome in out-of-the-way places unless a member of the crew is trained in this phase.

5. The carrying straps on the cases and on the power packs need to be replaced after three months of use and should be of better quality.

In several cases, we have checked the equipment on base lines established by the Coast and Geodetic Survey and have had

checks of from 1:50,000 to 1:300,000 over five- to fifteen-mile distances. Weather conditions do not seem to affect its operation, except when the temperature is below 15° F. Accurate results can be obtained through groups of trees when there is no wind and if the trees are 200 to 300 feet away from both the master and remote units.

At the present time I cannot say that our costs for large-scale photogrammetric surveys will be greatly decreased, because, in many cases, it is necessary to run auxiliary traverse lines for picture-point control based on the triangulation network previously established. I do believe that photogrammetric surveys using the Tellurometer equipment for establishing control points at predetermined intervals will certainly be more accurate and dependable and will influence highway engineers to accept photogrammetry for more and more uses.

❦ ❦ ❦

Experimental Small-Boat Charts*

The "unveiling" of the experimental charts of the Potomac River, designed especially for use by owners and operators of small craft, took place January 16, 1959, at the United States Power Squadron's annual exhibit at the Hotel Astor and at the National Motor Boat Show at the Coliseum in New York City.

These new charts, which cover the Potomac River from Washington, D. C., to Point Lookout, Md., have been developed under four different formats, and the Coast and Geodetic Survey has requested the opinions of the boating public concerning them. Reactions to the charts already issued will weigh heavily in determining the formats of similar charts to be produced for other important waterways.

Although the research and development program was only started in July 1958, the Survey has rushed to completion the following four series for evaluation purposes.

SERIES A: One sheet, 8-fold, printed both sides, at a scale of 1:800,000, with the Washington area at 1:20,000 scale, paper size 15 by 58 inches.

SERIES B: Three sheets, 4-fold, at a scale of 1:80,000, with 1:40,000 scale enlargement of Washington area, 14½ by 32 inch paper, supplemented by photographs of prominent land features and harbors.

SERIES C: Ten sheets, loose-leaf or fixed binding, scale 1:80,000, on legal size 8½ by 14 inch paper.

SERIES D: Eight loose-leaf sheets, scale 1:80,000, on 10¾ by 16¼ inch paper, including a 1:40,000 scale inset of Washington, D. C.

The charts of series B, C, and D, are designed for binders, and series A is an accordion-fold type.

Each series covers the same area and contains the same primary information. Large-scale insets of active boating areas supplement the main chart which is printed in four colors. The land area is buff colored and a blue tint indicates a water depth of six feet or less. Danger and restricted areas, velocity and direction of current, mileage marks, and fish traps are shown in red.

Supplemental descriptive information needed by the small-boat owners, and heretofore found only in the Coast Pilot volumes, has been added to the charts in tabular form. For example, at Cobb Island, near the mouth of the Wicomico River, the table lists 19 of the 20 different items that the skipper may want to know. These include, depths, tides, facilities such as berths, surfaced launching ramp, hull and engine repairs, 65-foot marine railway, electricity, toilets and showers, meals, and motor and rowboat rentals. The table also tells the mariner where he can get bait, tackle, gasoline, diesel oil, water and ice, groceries, hardware, and bottled gas.

The information listed in the facility table is also indicated by code number at the exact location on the chart. This number is actually based on the mileage from the mouth of the Potomac River. The number for Cobb Island is 33 which means that the island is approximately 33 miles upstream.

The experimental charts also show the signals for storm warnings, rules of the road, call letters and time of weather forecasts by marine radiotelephone stations, and an explanation of the chart symbols and abbreviations.

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* See SURVEYING AND MAPPING, July–September 1958, Vol. XVIII, No. 3, page 366, and October–December 1958, Vol. XVIII, No. 4, page 498.

Our Experience with the Tellurometer

By S. G. GAMBLE

TOPOGRAPHICAL SURVEY OF CANADA

THE Surveys and Mapping Branch of the Department of Mines and Technical Surveys received six sets of Tellurometers in April 1957. These were immediately placed on field trials by the Canadian Hydrographic Service and Topographical Survey in order to determine where they could be used to the best advantage on 1957 field surveys. Following several weeks of trials, during which time selected members of the field staffs were trained in the operation of the Tellurometers, two units were assigned to the Canadian Hydrographic Service and four to the Topographical Survey.

The Topographical Survey has now completed over 5,000 line-miles of Tellurometer traverse in various parts of Canada, and in all cases the Tellurometer has proved to be of great value, because it not only speeded up the work but improved the accuracy of our surveys.

The first two jobs attempted were near Ottawa and were carried out as advanced training exercises. One was a joint undertaking with hydrographers for the purpose of establishing major control for the development surveys of the St. Lawrence Seaway. On this survey a series of seven measurements, totaling 36½ miles, were taken along the length of Lake St. Francis between 11 a.m. and 5 p.m. of the same day. The other job was the establishment of primary control by Tellurometer traverse for the proposed photogrammetrical test range which will extend from Ottawa to Parry Sound. The first 35 miles of this traverse closed so well between the two Geodetic stations that no adjustment was possible, and the second course of 45 miles closed to one part in 60,000.

Tellurometers were used on several major surveys undertaken by the Topographical Survey. In the Fort Smith area of the Northwest Territories, 1,100 miles of survey lines were measured during the course of one month, the surveyors being transported by helicopter. The average length of line on this project was about ten miles, the minimum being three and the maximum 35 miles. The use of one set of Tellurometers for a five-week period advanced the completion of this survey by at least a month. The same Tellurometer was also used in the prairie parts of Alberta and Saskatchewan, where the field officer was able to complete some 1,100 miles of traversing despite the loan of the equipment to the northern party. Six hundred miles of chain traversing can normally be accomplished by a conventional traverse party in a slightly longer period.

It was on the horizontal control surveys for the mapping of the Ungava Peninsula that the greatest use was made of Tellurometers. This treeless area, with many hills rising several hundred feet above the lakes, proved ideal for Tellurometer traversing. With two sets of Tellurometers, the survey party was able to complete 2,700 line-miles of measurement in 38 working days and closures of 500-mile survey loops vary from 1:16,000 to 1:61,000, averaging somewhat better than 1:35,000. This project, which would have taken two years by conventional triangulation, was completed in one year by Tellurometer traverse.

On completion of the 1957 field season it was decided that Tellurometers would be used more extensively in 1958 by the Surveys and Mapping Branch. To ensure that advantage was taken of the experience gained in the field, several one-week courses on the Tellurometer were given to the members of the Topographical Survey field staff who had not used them. Training on this

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type of equipment is most important, and those selected to run Tellurometer surveys in 1958 will be given further instruction and practice in taking measurements before proceeding to the field.

In the northern parts of the central provinces of Canada there are large areas of flat-lying forested land. Such country is slow to traverse or triangulate. In order to establish an economical network of control, it is planned to extend a series of quadrilaterals, using distance measurements rather than angles. To do this without having to build towers, the antenna assembly will be mounted on a mast 30 to 40 feet above ground. Experiments conducted to date, with a set modified by the National Research Council of Canada, have indicated that a range of 10 miles is practical with such an arrangement. It would be reassuring, however, to be able to depend upon ranges of up to 15 miles, and methods of increasing the range to this distance are being investigated by our Research Council. Measurements are being attempted this winter on the boundary survey between the Northwest Territories and northern Saskatchewan, using the separated antenna, with both the master and the remote units winterized for operation under very cold weather conditions.

We shall soon know whether the Tellurometer has proved to be as useful on this type of survey as it has for establishing horizontal control for photogrammetrical mapping.

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Aeronautical Charts

Preparing charts for aerial navigation is one of the most vigorous and prolific branches of cartography. Because of the different navigational and landing requirements of the many types of commercial and military aircraft, a variety of air charts are produced. The need for frequent revision of aeronautical charts adds to the quantity output which runs into millions of sheets each year.

The challenge posed to mapmakers by the rapid evolution of aircraft has necessitated extensive and continuous research to devise new and to perfect existing cartographic navigational aids. The literature on aeronautical charts, reporting on such studies, is accordingly quite voluminous. Many such references were listed in this reviewer's *Aviation Cartography,* published in 1956.*

Several recent studies by German cartographers supplement and complement the abovementioned publication. *Nachrichten aus dem Karten- und Vermessungswesen,* a new cartographical serial published by the Institut für Angewande Geodäsie (Frankfurt a/M), devoted most of its initial number (1956) to aeronautical charts. Herbert Knorr deals with the German sheets of the 1:500,000 ICAO series in his article entitled "Zur Bearbeitung der Luftfahrtkarte—Aeronautical Chart—ICAO 1:-500,000 von Deutschland."

In the same journal is Karl-Heinz Meine's "Flugsicherung und Luftkarte" which discusses the need of good aeronautical charts for safe navigation. The paper includes a brief historical summary of the development of air maps, including references to the several international conferences which were held with the objective of standardizing charts. There is also a section on the ICAO series, with special attention to the 1:500,000 chart. Appended to Meine's paper is a bibliography of 105 references, a number of which are not in the Library of Congress publication noted above.

Meine is also senior-author (with E. Reents) of a book on aeronautical charts entitled *Die neuzeitlichen Luftfahrtkarten und ihre Anwendungsbereiche,* published by R. Eisenschmidt (Frankfurt a/M) in 1957. Chapter subjects include the significance of maps in air navigation, symbols for aeronautical charts, the influence of ICAO on aviation cartography, ICAO charts for terrestrial navigation, the limits of aeronautical cartography, and special maps for air navigation. There is a bibliography of 92 titles, more than three-fourths of which are dated 1951 or later. A pocket on the inside back cover includes samples of several German aeronautical charts, index maps, and symbol sheets.

WALTER W. RISTOW

Library of Congress

* Ristow, Walter W. *Aviation Cartography.* Washington, Library of Congress, 1956. 114 pp. $.85.

Performance and Preservation of Highway Control Surveys

By BENJAMIN EVERETT BEAVIN, SR., P. E.

BENJAMIN E. BEAVIN COMPANY

THE GUIDING PRINCIPLES of highway surveys have not changed very much during the past ten years. However, the principal reasons for making the surveys—namely, modern highways—have become much more important, complex, wide, straight and expensive. This should have resulted in surveys of comparable quality, usefulness, and permanency. Sad to relate, in many instances such is not the case.

Highway surveys should be planned carefully and controlled rigidly. Second-order, horizontal control should be available, or made available, to the highway surveyor, at intervals along the proposed highway rarely exceeding five miles. This control should be in the form of pairs of intervisible monuments, well referenced, or a single monument with at least one distant, permanently marked sighting point. To lessen the chance of this basic control being lost, a subsurface mark should be set for each of these monuments.

Intermediate control may be extended along the route by separate traverse or by the centerline survey, performed to second-order standards, with a closure error in position after azimuth adjustment not greater than 1:10,000.

This intermediate control should be consistent in quality, with every effort made to eliminate blunders (particularly in chaining). No method of adjustment will take care of inconsistent work.

Traverse should be carefully adjusted between basic control points and recomputed bearings and distances used as final values. Coordinates should be computed on the State Coordinate System.

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While the traverse is being carried forward, a few angles, measured to distant coordinated points, often make possible a more realistic adjustment. A horizon sweep, at advantageous traverse stations, takes only a few minutes.

This initial traverse need not be monumented. The angle points should be marked, preferably with center marked pipes or pins, and carefully referenced. A little care in selecting the location will insure more certain and easy recovery.

Assuming that the traverse is completed, adjusted, and the results available to all concerned, every measurement thereafter should be referenced accurately to this framework. Fences, hedgerows, corner stones, and other markers within or near the right-of-way, streams, existing roads and all the other planimetric and topographic data necessary to a good highway survey—all may be coordinated, if so desired, from such permanently referenced surveys. Carefully surveying the culture permits close design of bridges, retaining walls, underpinning, storm drainage, etc.

Especially important is the responsibility that highway officials bear, to perpetuate the exact location of any landmarks that may be destroyed—sometimes necessarily, sometimes carelessly—in the construction of the highway. Much of the cost, and some of the uncertainty, of present day surveying is due to widespread defeat of important boundary markers in unequal struggles with bulldozers. However, any point, once coordinated, may be considered permanently fixed, even though no physical marker is set.

The techniques of traversing and topographic surveying are well known to all of you, so I will dwell briefly on a later phase of the problem—transferring control to permanent marks.

Setting permanent monuments before construction is complete is a discouraging and costly operation. In my own practice, I provide on the construction drawings, that all structures, such as bridges, culvert headwalls, storm water inlets, and some manholes, be made potential permanent bench marks and traverse stations. This is accomplished simply by having the contractor install 2″ brass, oval, Phillips-head screws in the masonry of each structure, at a convenient location, while the masonry is being placed. These screws cost about five cents each. Many of these points may not be used, some may be omitted, but the total cost for providing potential permanent points probably does not exceed $2.00 per mile. One monument, in place, will cost ten times as much. I use monuments only where structures are too far apart or are not intervisible.

Once the horizontal and vertical control is transferred to these points, they are available for control of:

1. The remainder of construction
2. As-built surveys
3. Staking right-of-way lines
4. Future surveys of adjacent land
5. Surveys for future connecting highways and other public works

Based upon this system, the highway engineer would use great care in fixing coordinates of every angle point in the right-of-way limits, but would only determine the lines of bisected properties closely enough to acquire title. He would leave the exact determination of adjacent property boundaries to land surveyors, if and when such determination would become necessary. Thus, the costly, time consuming and unnecessary operation of surveying many properties for the highway taking can be simplified. However, the coordinates of landmarks to be destroyed by the highway construction should be shown on the drawings in order that future surveyors may use the information.

I dare say that not one of us has escaped that frustrating experience of attempting a survey along a newly constructed highway, only to find not a single permanently marked and identifiable point provided to perpetuate the original surveys. I submit this is a waste of good assets, and one we can afford no longer.

REFERENCES

BEAVIN, BENJAMIN EVERETT, SR.: The Use of Plane Coordinates in Property Surveys. Presented to the American Congress on Surveying and Mapping, August 27, 1945.

BEAVIN, BENJAMIN EVERETT, SR.: The Use of State Plane Coordinates in Engineering Surveys. Presented to the American Society of Civil Engineers, Philadelphia, April 1946.

BEAVIN, BENJAMIN EVERETT, SR.: Use of Plane Coordinates in Highway Planning. Presented to the Planning Division of the American Road Builders Association, Washington, D. C., January 28, 1948, and reprinted in SURVEYING AND MAPPING, October–December 1948, Vol. VIII, No. 4, pages 226–229.

BEAVIN, BENJAMIN EVERETT, SR.: Surveys and Maps—Vital to the Solution of Problems of Mass Transportation. Presented to the American Society of Civil Engineers, October 1953.

BEAVIN, BENJAMIN EVERETT, SR.: Surveys in Transportation Engineering. SURVEYING AND MAPPING, January–March 1955, Vol. XV, No. 1, pages 57–58.

Abstracts of Technical Papers

A bibliography on aerial surveying and related subjects will be published by International Training Center for Aerial Survey, Delft. This publication is sponsored by the International Society of Photogrammetry and actively supported by the American Society of Photogrammetry. It will include abstracts of technical books and papers from both American and European literature. These abstracts will be translated into English for U.S. subscribers and printed on file cards for convenient reference. The rate will be $1.50 per 100 titles, which will consist of about 350 abstract cards; the cost of postage will be extra. At regular intervals, the abstracts from current articles will be published and distributed to subscribers. If you are interested in this service, please write to Mr. Corten, c/o International Training Center for Aerial Survey, 3 Kanaalweg, Delft, Netherlands.

Massachusetts Control Surveys for Federal Highways

By ROBERT W. HUNTER

ENGINEER, MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

PERMANENT MONUMENTATION should be borne in mind and provided for from the earliest planning stages of the development of a right-of-way, whether it be an interstate superhighway, or a private way in a subdivision. To this end, all surveys in connection with the proposed right-of-way should be referenced to a permanent system of control based on the national network, thus providing not only permanence, but a lasting usefulness of all points of the surveys to surveyors of abutting properties, public utilities, and other future projects. It is presumed that, in practically all cases, the permanent system of horizontal control would be the State coordinate system based on the 1927 North American Datum as established by the Coast and Geodetic Survey, and the vertical control would be based on the 1929 General Adjustment.

The reasons for adopting these systems are fairly obvious, but three of the most important of them may be worthy of mention. *First,* because they are both based on accepted fundamental data of the North American Continent, points once established can always be reproduced should they be lost. *Second,* if the surveys are performed to the specifications of second-order accuracy, all points of the survey become control points for future work. *Third,* the State coordinate systems are plane rectangular systems which allow the average surveyor to handle the computation of traverses with plane trigonometry, yet the coordinates can be readily converted to geographic positions, should this be desired. From the geographic positions, coordinates may be computed on any other grid which is based on the 1927 North American Datum, such as the Universal Transverse Mercator grid.

By taking advantage of the provisions of the Federal-Aid Highway Act of 1956, the States can make this control available along the routes of interstate highways by paying only 10 percent of the cost. This presents an opportunity for States not using the coordinate system at the present time to set up the framework at very small expense, and for those States which have adopted the system to extend it. In Massachusetts we were fortunate in having our Geodetic Survey set up and operated as a WPA project from 1933 to 1943, under the direction of Mr. Elmer C. Houdlette who is well known to this Congress. During those years several thousand horizontal- and vertical-control stations, conforming to Coast and Geodetic Survey standards of accuracy, were established throughout the State.

In 1941, the State Legislature enacted a law defining the Massachusetts Coordinate System as established by the Coast and Geodetic Survey and legalized its use for the description of land.

The maintenance of the work accomplished during those ten years, the dissemination of data among engineers and surveyors, and the expansion of the coverage has been carried on since 1943 by the Geodetic Survey Section of the Department of Public Works. This section is now being enlarged to take care of the additional work imposed by the accelerated highway program. The field parties of the Geodetic Section are equipped with instruments of the most recent design and of high precision for extending control of any degree of accuracy. Included are Wild T-2's, a Wild T-3, Zeiss self-leveling levels, and traverse target equipment. A Tellurometer has re-

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cently been purchased for the use of the Geodetic Section, and it is now undergoing a series of familiarization tests in the field. For the past few years the section has been given the responsibility of computing and adjusting the survey base lines for all new major highways. The work of this section has proved to be invaluable, not only to our own department, but to other agencies of the State, engineers of counties, cities, and towns, as well as public utilities and private engineers.

A TYPICAL EXAMPLE

To illustrate how we achieve permanent monumentation through the use of the coordinate system, I would like to trace the layout of a highway from its inception.

A tentative route for a proposed highway is chosen and sketched on the U. S. Geological Survey's topographic maps. Using this as a centerline, flight strips—one mile wide through rural areas or one-half mile wide through urban areas—are marked out and a contract is let to an aerial survey company for topographic mapping of the area at a scale of 1:2,400 or 1:1,200.

Our specifications for this contract require that the company use the State coordinate system for their control surveys and that permanent or semipermanent markers be established at intervals along the route. These surveys are required to be of third-order accuracy in rural areas and of second-order accuracy in urban areas. The markers are required to be shown on the maps and described so that they can be recovered in the field.

After careful study, a final base line, or proposed centerline of construction, is plotted on the photogrammetric maps and the coordinates of the points of intersection scaled. Using the scaled coordinates, a preliminary computation of the base line is made and ties are figured from the control markers to strategic points along the line, so that survey parties may fix the line on the ground in the exact position that it was laid out on the map.

I call attention to another advantage at this point. In case of heavy growth or other obstructions along the line, the work of clearing the base line may be started simultaneously at several points, without waiting for the time consuming operation of plunging a long line through dense woods by a single crew.

Distances and angles of this final line are then measured to second-order accuracy, and the line is tied to basic control at each end as well as at one or more points between. The field notes of this work are then sent to our geodetic computing section where they are reduced, and the traverse is computed and adjusted. The traverse must close within the limits of second-order accuracy or the notes are returned to the field for remeasurement.

Suitable markings are then set along this base line so that they are visible from the air, and new contracts are let for photogrammetric mapping of a strip 1,200 feet wide at a scale of 1:480, using the flagged base line as a centerline.

Property lines, as determined in the field and tied to the base line, are plotted on the "40-scale" maps, together with the final design of the highway. A right-of-way layout is computed and referenced to the base line. The side lines of the layout are thus coordinated on the State coordinate system.

When the road is constructed, permanent monuments are set at all controlling points on the side lines and, if the highway consists of a double roadway with grass median strip, bounds are also set at controlling points on the base line. The monuments used to mark the side lines and base line are reinforced concrete bounds, six inches square and six feet long, with a brass pin leaded in the center of the top to indicate the point. They are usually set with not more than six inches above ground, and, in many cases where this would be objectionable, such as mowing, they are set flush.

From this brief description, it can be seen that all state highway side line and centerline bounds, set in accordance with the above procedure, become additional permanent control points on the State coordinate system. They are available for the use of the private property surveyor who wishes to make a survey of land adjoining or near a state highway layout.

RESPONSIBILITIES OF THE PROPERTY SURVEYOR

I would like at this time to point out one or two responsibilities of the property surveyor in achieving permanent monumentation.

First, whenever a surveyor uses a control station, whether it be a triangulation station, geodetic traverse station, bench mark, or highway side line bound, a report should be forwarded to the proper agency, giving the present condition of the marker, the correct designation, any additions or corrections to the description, and any additions or corrections to the ties which would make the station easier to find in the future. Many agencies have forms available for this purpose, similar to those of the Coast and Geodetic Survey. In Massachusetts we encourage the use of these recovery forms to keep our files up to date.

A *second* responsibility of the property surveyor is the care and accuracy with which he uses the coordinate system. It must be borne in mind that no point to which coordinates have been assigned can be reproduced with any greater degree of accuracy than that used in the survey which first established those coordinates. Therefore, to insure the permanency of the points on any survey, the traverse tying those points to the permanent control system must be run using methods and equipment which will insure an accuracy commensurate with the economy of the survey. If a survey is carefully made and properly tied to an established control system, the points on that survey may be considered truly permanent, and, if lost, may be reproduced with the same degree of accuracy as that used in their original establishment.

THE FILING SYSTEM

With the increasing use of control and the expansion of the control systems, it becomes increasingly important that the records and notes on such control be properly filed to be readily available for use.

The filing system used in our Geodetic Section has proved to be very satisfactory and will be described here as an example of a procedure which can be modified to suit individual needs.

Triangulation projects are assigned accession numbers and the computations of each project are bound in suitable binders and filed according to the accession number. Individual triangulation stations are given names and indexed alphabetically. Three $5'' \times 8''$ cards are made out for each station. One gives a complete word description of the station, reference marks, and, if necessary, directions for reaching the station from some well-known landmark. There are also geographic azimuths to an azimuth mark and to the reference marks. On the back of the same card is a detailed sketch of the immediate vicinity of the station, showing the relative position of cultural features and the reference marks. The second card contains all geographic data, such as the latitude and longitude of the station and the azimuths and distances to other visible stations in the same network. The third card contains the X and Y coordinates on the State coordinate system, together with grid azimuths and distances to other stations. On each of the cards there appears the accession number of the computations, and a code indicating the accuracy order of the station and the agency which established it. The three cards are filed alphabetically by station name in three separate files entitled "Descriptions," "Geographic Positions," and "Grid Positions."

Traverses are run between triangulation stations and each traverse is assigned a number. The computations are given accession numbers consisting of the traverse number or, in the case of two or more traverses being computed together, the combined numbers. The computations are filed numerically. Each station of a traverse is identified by the number of the traverse followed by a letter or letters. A $5'' \times 8''$ card is made out for each station, giving a complete word description of the mark, ties to permanent objects in the vicinity, and other pertinent information which would be helpful in recovery. This card also gives the X and Y coordinates on the State coordinate system, grid distances and azimuths to other visible stations, the elevation of the

station, and the accession number of the computations. On the back of the card is a sketch similar to that described for the triangulation stations.

Because it is usually desirable to refer to control in one particular area for a specific project, these traverse data cards are filed according to geographical location. In Massachusetts they are filed by cities and towns with the various traverses in each city or town separated and identified by traverse number. This would be impractical outside of New England where the boundary lines of towns are not contiguous, but any convenient subdivision might be used, such as the county or the 15-minute or 7½-minute quadrangle, depending on the density of the control.

Level runs are assigned area numbers and the computations are filed according. Bench marks are numbered consecutively and are identified and indexed by these numbers. A 5″ × 8″ card is made out for each bench mark, giving a complete description of the mark, ties to permanent objects, and the elevation above the Sea Level Datum of 1929.

All computations of triangulation, traverse, and levels refer to the original field notebooks by number. The books are numbered consecutively and filed accordingly for future reference.

INDEX MAPS

To further facilitate the location of control available in any given area, all stations and bench marks, with their designations, have been plotted on the 7½-minute topographic maps of the U. S. Geological Survey. These maps are available at the office of the Goedetic Section for reference, and photostats of them can be made to send to interested persons. From the topographic maps, control can be selected by a surveyor wishing to work in a particular area and photostats of the individual 5″ × 8″ cards made for his use.

To insure the permanency of the files of the Geodetic Section, a microfilm record was made by the Army Map Service of all cards and topographic maps. The original is stored in their vaults and a copy has been supplied to us. We are hoping to bring this microfilm record up to date from time to time and store it in a permanent place of safekeeping.

CONCLUSION

In conclusion, I would say that the most important points to stress for permanent monumentation are:

(1) The survey should be tied to the permanently established national control network through the State coordinate systems;

(2) Personnel for prosecuting the work should be selected for their qualifications in making surveys of high precision;

(3) Methods and procedures used in making the surveys should adhere rigidly to the standards required for the particular order of accuracy which it is desired to attain; and

(4) Records of the survey should be filed in such a way as to make them readily available for future reference.

Short Course for Land Surveyors

Sponsored by the Georgia Association Registered Land Surveyors and in cooperation with the School of Civil Engineering of the Georgia Institute of Technology, the biennial "short course" in surveying and mapping was scheduled to be held on the Georgia Tech campus January 29–31, 1959.

This course, designed to acquaint the licensed land surveyors of the State of Georgia with improvements in surveying equipment and techniques, will also include talks by lawyers and Trust Company officials on salient changes in the legal aspects of land surveying.

While announcement of this short course reached us too late to write of it in the future tense, anyone interested in the next (1961) program should communicate with Professor James H. Lucas, School of Civil Engineering, Georgia Institute of Technology, Atlanta, Georgia.

The Rantone Process in Mapmaking

By DUNCAN M. FITCHET

RAND MCNALLY AND COMPANY, CHICAGO

THE WHOLE FIELD of applied cartography is extremely exciting and dynamic. New techniques and developments occur so rapidly that one can scarcely keep abreast of major changes in methods, much less master the infinite detailed refinements introduced in basic processes by one organization or another to "make the cloth into a suit." A once sedate profession has been revitalized with exciting revolution. The marvelous part of it is that it feeds on itself. Minds are made active and alert by the chain reaction of improved cartographic technology.

Rand McNally, like nearly every mapping agency in the country today, has hurdled most of the obstacles in the scribing process, and is successfully correlating processes that precede and follow. Presently, our attention is devoted to detailed refinements aimed at solving very specific problems. The commercial mapmaker today finds his job a very stimulating one. He is not concerned ordinarily with the production of series of maps of standard specifications. Each day he faces the challenge of a different map problem with every new job. Experience gained on one job can rarely be applied to the next. During the long years of relative stability in mapmaking methods, he was able to take a conservative approach, using techniques of proven effectiveness and time-tested systems and procedures. There were few alternatives. The tempo of the "cartographic revolution" today is such, that even the most conservative mapmaker must be daring enough and opportunist enough to capitalize on new and sometimes untried ways of making maps in certain applications, in order to offset high labor costs and competition.

Scribing, certainly, has made great inroads into the mystery and complex of confusion that was cartography. Rand McNally, in common with other organizations, has succeeded in sifting "the wheat from the chaff," and changing mapmaking techniques into simpler forms through improved organization. Most of us face similar problems, although the end products may differ.

The commercial mapmaker, by the very nature of the maps he produces, is confronted with some particularly unique problems. Three principles are ever prominent in his planning:

First, he must accurately predict the economic cost of each job, using the best available procedures. Nearly every job is a "one-shot deal." He is not blessed with the luxury of being able to refine and improve a procedure that, over a series of similar maps, will result in lower cost and a better product.

Second, he must be ingenious enough *creatively* to develop ideas that will capture the imagination of the customer and the public. This introduces a world of variety, such as original map design, new approaches to familiar problems, and the use of styling for eye appeal.

The commercial mapmaker may be confronted by such varied problems as designing and producing an airline map, street maps for an oil company, portraying simplified geographic concepts for 4th grade students, preparing wall maps for college use, black-and-white sales-control maps, pictorial maps for corporate annual reports, political maps for general reference, State highway and road maps, or maps of the Moon and Outer Space. At the present time, Rand McNally artists are working on at least four different types of maps of Outer Space. Each situation involves an unusual combination of design, cartography, and practical printing.

Many government agencies have under-

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taken user-analysis studies to determine whether the maps they are making are functionally sound and designed with the user in mind. Academic cartographic personnel have been engaged to assist in these analyses. This is commendable. In business competition, where producers vie for customer and consumer approval, commercial producers too are concerned with market acceptance. We are always sensitive to consumer reaction. Does our product meet the desired objective? Is it useful? The measures of effectiveness are frequently very positive. The product either sells or it does not. Many factors are contributing, such as price, methods of distribution, advertising, content, and appearance. These are not listed in order of importance. In fact, an inverse listing might be more nearly correct.

For many years, map design has been the job of senior cartographers and product-development personnel. We now question whether the geographer or the cartographer alone is always effectively equipped for this role. Recently, we have transferred map design from the cartographer to professionally competent design personnel, who are not rigidly bound by cartographic convention. Within an established framework of specific objectives, they are free to design our maps —that is, with respect to artwork, type, symbolization, line weights, and coloration; and to create serviceable, attractive works of graphic art. Cartographers and designers work in a collaborative effort. Part and parcel of this whole trend is the development of new designs for screens, symbols, and type faces specifically to serve unique cartographic situations.

Third, the commercial cartographer must have great flexibility. He must, at every turn, be prepared to give the customer a more detailed and a more attractive product than his competitors can produce. Variety is necessary. Visual impact is essential. But, economics demand that the symbolization, design elements, and typography permit reproduction of the same basic map in a variety of scales. Variety and flexibility are keystones of commercial success.

In this period of cartographic revolution, the most neglected area has been in map typography and type placement. If there is one distinctive characteristic of commercial mapping, it is the demand for dense type stickup with legibility and variety on relatively small scale maps. This is a real problem. The cost of typing a map (in that I mean to include type listing and symbol selection, type setting costs, and type positioning costs) amounts to between 35 and 50 per cent of the original cartographic cost. On commercial maps, and most typically on road maps, this is the area of cartographic production where the needs for skills are greatest, the results are most important, contrast and definition are most essential, and speeds the slowest. The road map must be detailed enough to show every place the driver may look for, and be legible enough for him to read with ease and to relocate his position quickly. Maps with as many as 75 pieces of type and symbols per square inch sometimes confront us. Fifty names or symbols per square inch are common on road maps.

Today, only hot metal type offers the variety of faces, within practical and reasonable cost, needed for this purpose. Frequently, our needs call for sizes that are not available. We are hopeful that the various forms of photocomposition ultimately will have the variety, selection, and economy to make them practical for commercial cartographic use, for they have the required size flexibility and reproduction quality. Rand McNally has a huge investment in hot metal forms of type, and a large number of faces and sizes acquired over the years to implement map, book, and printing production. This suggests a vested interest in making as much use of this equipment as possible. We strive for quality in photocomposition, and feel we have hit an adequate, temporary substitute that provides corresponding quality and permits us to continue to use our hot metal equipment, overcoming its limitations nad capitalizing on its obvious advantages.

Several years ago, Ludlow Typographers developed two or three prototype models of a machine for their Brightype process. We have chosen to call it Rantone. One of two

early, pilot models was installed in Rand McNally's Decatur, Illinois, typesetting plant. This machine employs a photographic process whereby combinations of type, engravings, and letterpress map plates can be photographed directly on sensitized film or paper. Its principal advantage, as far as mapmaking is concerned, is that it gives a beautifully sharp image of the type without *impression*, the principal weakness of hot metal type. Simply expressed, the process involves spraying the type or letterpress engraving with an opaque solution which dries upon contact. The image areas are deftly burnished with an engraver's rubber eraser, just enough to remove the opaque solution from the image and to give a reflective shine. This form is then positioned before the camera. A battery of lights, mounted on a circular band, rotates about a fixed camera lens to give uniform light distribution to the entire image area. Film postives can be made for deep etch or albumen reproduction. Much of the type for our map stickup is prepared in this manner on strip film which is waxed before placement. The positives make excellent camera copy for reduction, if necessary.

In practical operation, the operator can sharpen the image of new type. With worn type or old letterpress map engravings which we wish to convert to offset, where the image is rounded with wear, the burnishing operation sharpens only the apex of the image area, restoring much of the original quality of the engraving.

The principal advantage of this process for cartographic stickup is that it avoids the problem of impression which inevitably, even though slightly, "fattens" the transferred image of even new type on the best of etch proofs. It enables us to get the highest reproduction quality of type for original stickup, yet to retain the numerous advantages of variety available in hot metal type.

The equipment for Rantone was made available on the market in January 1958. The principle is not much different from that employed by many European firms for making duplicates of copper engravings.

Steps already have been taken to mechanize the type-stickup operation. Two machines have been developed that offer great hope. In 1952, the French roadmap firm of Michelin developed a prototype machine for photomechanically positioning type. They call it the Nomafot and nickname it "Bibette." It was developed for them by SOM in Paris after three years of engineering collaboration. This machine now has been in map production for six years. A type image is projected from a film positive to a manuscript map copy. The operator positions the image of the name in the proper location on the manuscript. The exposure is made when a duplicate image of the type is transmitted by another projector from a negative film to an identical position on the sensitized reproduction surface.

Michelin technicians reported in 1956 that they could position as many as 150 names an hour with a type plate of medium density. A skilled craftsman must first indicate the proper locations on the manuscript for each piece of type with tick marks, and later the machine operator exposes the type in position. The prototype machine cost Michelin 11,000,000 francs or $32,000.

The Staphograph, a more effective successor to the Nomafot, is used at Army Map Service.

A somewhat different machine, developed by Hoh and Hahne in Offenbach, Germany, has been available for the past two years. This machine, called the Kartolux, is widely used in Germany, but to my knowledge no model is in service in this country. It is infinitely simpler in design and correspondingly lower in cost than the Nomafot. It operates on an entirely different principle, with the manuscript image and sensitized film or glass plate horizontally imposed side by side. The sensitized surface is covered in a light-tight box. The Kartolux also involves the projection of an image of the type, from a negative or positive, first on a manuscript copy, and then by manipulation the manuscript is moved aside, and the sensitive surface is brought to an identical position under the projector. The hand manipulations immediately imply

that the machine is slower and less efficient than the French machines. The Kartolux has many similarities to the Staphograph, but one particular advantage. The type image can be enlarged 100 per cent or reduced 50 per cent by projection to fit an accommodating space. Present models of the Kartolux are limited in size to a workable area of 22 by 26 inches. This can easily be overcome. The price of the Kartolux installed is slightly less than $2,000. The manufacturer claims that German map printers have been able to save up to 70 per cent of the their type-stickup cost by the use of this machine. The actual saving, of course, varying with the difficulty of the work.

We at Rand McNally are not certain that either of the above-described machines represents the ultimate in mechanizing type stickup, but they certainly hold bright prospects for the future. Our company has tentative plans to acquire machines of both types during 1958. One important factor in our consideration is that each machine is dependent upon film negatives of type for projection. The Staphograph requires a roll of film that is very carefully and precisely calibrated. The Kartolux can be adjusted to use almost any type of film negative. We expect that minor adaptations can be made in our Rantoning procedure so that we can obtain suitable negatives for use on either machine. Thus, we can combine the advantages offerd by the variety of hot metal type, the quality of photographic images, and, we hope, the positioning advantages of the photomechanical machines.

The ultimate answer to our problems, I believe, will be a photocomposition system integrated with a photomechanical type of positioning machine. This seems particularly feasible if requirements of type size, type face, and symbolization can be standardized. In the immediate future, we frankly look to a combination of photomechanical type positioning and Rantone images of hot metal type as our best solution.

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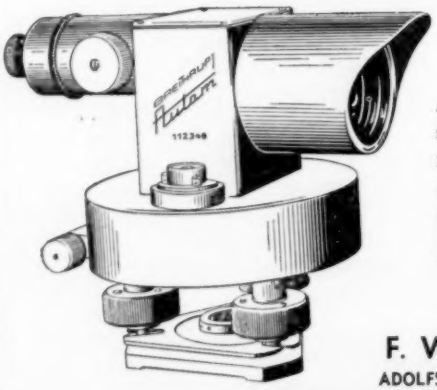

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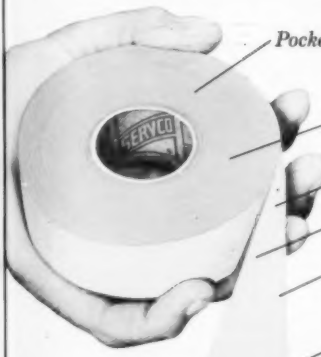
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Elastic Compilation Materials

By KENNETH R. DEARDORF*

THE CONCEPT of changing scale and proportion on cartographic products by printing the image on a stretchable elastic medium is very old. Yet, when it has been proposed, the idea has been most often rejected, sometimes with ridicule, sometimes with hilarity. There are several reasons—or explanations—for this attitude. First, the universal search for cartographic production media of high dimensional stability has perhaps rendered the notion of a completely unstable material almost intolerable. Then, too, in the experience of this writer, much thought on the subject has been concerned with the stretching of entire sheets, instead of the technique of applying elasticity in "small doses." This is not to assert that the entire-sheet treatment is impractical. However, the simpler approach has been found quite efficacious, and elasticity is now being successfully employed as a map production tool, to a limited extent, at the Aeronautical Chart and Information Center.

Conventional methods of altering scale and shape of map source material, to conform to the scale and kind of geographic projection on which a given map or chart is to be constructed, are generally known. However, some types of alterations do not lend themselves readily to conventional treatments. They include those in which extensive, nonsymmetrical alterations are required, such as converting from a transverse Mercator to an azimuthal projection, or from one azimuthal projection to another. While such requirements gave immediate impetus to the idea of using elastic working materials, the technique has been found advantageous also for conditions for which conventional methods can be readily employed. The mechanics of the elastic type of procedure, as typically applied, are here described.

A transparent or translucent sheet of plastic, bearing an image of the geographic projection on which the compilation is to be based, is placed upon a "light-table" (a glass-topped table illuminated from within), and firmly fastened in place with pressure-sensitive tape. On this, a transparent blank sheet is firmly taped, over which the latex

sheeting is then stretched and affixed. (If the projection copy is expendable, there is no need for the second sheet, and the latex sheeting may be placed directly upon the projection sheet; the "damage" may be insignificant. Unless the sheets are firmly taped to the table they will curl as the stretched rubber sheet strives to retract.

Narrow strips of transparent tape, with pressure-sensitive adhesive surfaces on both sides, are applied to the surface of the plastic sheet, following the lines of the graticule. The criss-crossing strips of the tape over the working surface results in a "lattice" effect.

The sheet of latex, bearing the image of the geographic features to be converted (and the source map graticule), is now brought over the area. The graticule lines are matched to those of the compilation, and the rubber sheet is firmly affixed to the lattice of pressure-sensitive tape, line by line and frame by frame, stretching the rubber

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as necessary to achieve an exact matching of the two sets of graticule lines. When the lines are matched, the geographic detail in the non-adhered spaces continuously and automatically adjusts itself to the size and shape of each "frame," by the normal and uniform elasticity of the latex. It is usually necessary to reinforce the adhesion of the outer edges of the latex sheet with strips or "tabs" of pressure-sensitive tape (single-faced), extending beyond the limits of the lattice, since the greatest strain occurs around the periphery of the latex sheet as a whole, and the lattice by itself may not hold it.

This extended image is not suitable for reproduction, and is relatively impermanent. The adhesion is subject to "creeping," although a sufficiently dense latticework and enough supporting peripheral tabs will maintain the registration of the two graticules for several days. The image is therefore traced from it to the final compilation manuscript. The latex assembly is dismantled and discarded after it has served its purpose. The latter may or may not be reclaimable, depending on what photosensitizing process has been used to put the image on the rubber. It is rarely "worn out" by a single usage. However, the latex is relatively inexpensive, and reclamation may cost more than the material saved.

The latex, or rubber sheeting, is very thin and elastic. The product generally known as "dental dam," 30-gauge, obtainable from medical and dental supply houses (about $1.65 per square yard) has proved to be satisfactory. Light beige in color, its semitransparency permits the necessary visual matching of the two graticules, or other controlling framework. Its thickness, consistency, and elasticity, are likewise uniform, at least within workable limits. Best results are obtained with a minimum of stretch. As it stretches and the distance between points or lines of fixation increases, the uniformity becomes less dependable. A large number of elastic substances, plastics as well as rubber, have been tested, and some have shown distinct promise, but so far no material quite as effective as thin sheet latex has been found. Experiments in forming sheet material by painting or spraying liquid latex or other materials on flat surfaces, have also not yielded practicable results. Presumably, an elastic medium would be easier to handle if adhered initially to a rigid or semi-rigid surface such as a sheet of transparent plastic, for photographic and other processing, from which it could be stripped for adjusting to the desired size and shape. Some such technique might conceivably be developed.

Instead of double-faced pressure-sensitive tape, liquid adhesives of various kinds have been tested, as well as the technique of adhering the entire latex (or other material) sheet to the base. One adhesive, a "permanently tacky" cement, permits practically unlimited lifting and reaffixing of the elastic material with consequent like opportunities for adjustment. However, no method of fastening the entire under surface of the elastic sheet fully permits the elastic material itself to assist in the adjusting operation, as is possible in a lattice or other framework, or separated points, system.

As might be expected, processes by which a usable image can be obtained on a sheet of latex are distinctly limited. Photographic emulsions of the conventional variety break away when the rubber is stretched. Dye-process materials have shown the most promise. Currently, a process known as "Camcote" is providing a sufficiently durable and tenacious image. However, this medium does not photograph well. Further development in this direction might be desirable.

The technique is apparently best adapted to very small scales and unsymmetrical areas. However, it has been successfully utilized in connection with a transverse Mercator projection at 1:500,000 scale. Editing is understandably a bit difficult, for there is nothing "solid" on which to base a check. However, proportional measurements give a fairly good indication of the accuracy of feature positions, and cartographic omissions and mistreatments are as easily checked as with other techniques.

An added advantage is that reductions, as well as enlargements, are possible. The

image may be traced or processed upon the latex while the latter is in a stretched condition, after which is may be allowed to retract to a smaller size and shape. Compilation on curved surfaces, such as globes, or physical-relief models, is also a potential application of this technique which may bear investigation.

There is little doubt that electronic techniques will soon permit precise modification of graphic matter to extreme and unsymmetrical variations in size and shape. In the meantime, the use of elastic compilation media offers one more tool in the mapmaker's box of tricks for adapting source materials to his purpose.

The Aeronautical Chart and Information Center expects to issue a formal Technical Report on this technique in the near future.

"The Ephemeris, 1959"

The 50th or Golden Anniversary Edition of the astronomical almanac, issued annually by the Bureau of Land Management for the use of its cadastral engineers, is available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 30 cents.

The Ephemeris is arranged primarily for the use of cadastral engineers rather than astronomers. It contains daily entries for the Sun's apparent declination and semidiameter; the equation of time; time of upper culmination, time of elongation, and declination of Polaris; as well as times of transits and declinations, at half-month intervals, for each of 28 selected stars.

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The Proper Expression of Survey Data as Applied to Large-Scale Topographic Maps

By SEYMOUR S. HACKETT

AERO SERVICE CORPORATION, PHILADELPHIA, PENNSYLVANIA

PHOTOGRAMMETRY is being successfully applied as a method of preparing large-scale topographic maps for the purpose of design planning of highway facilities in the present Federal and State roadbuilding program. The highway engineer requires a map of sufficient horizontal and vertical accuracy so that the planned structures will fit the actual terrain when staked and constructed on the ground.

The successive stages in highway planning begin with preliminary study of existing maps, such as Geological Survey quadrangles, and proceed through reconnaissance of the area by means of higher-altitude photography to determine the reasonable route alternatives, selection of the best route, and preparation of the preliminary survey at the usual scales ranging from 1 inch = 200 feet to 1 inch = 400 feet for the design of the location and preparation of construction plans. The final-stage design mapping includes a topographic map, generally at a scale of 1 inch = 40 feet, a centerline profile of the planned route, and cross-sections of the existing terrain.

The highway engineer is dependent upon reliable photogrammetric mapping engineers for advice and help in the proper correlation of photography scale, map scale, contour interval, and other requirements necessary because of the type of topography, ground cover, and intensity of land use. Expert advice is also needed in selecting the photogrammetric equipment and methods considered most reasonable and suitable for fulfilling the particular mapping requirements.

At the present time, a considerable amount of study and accuracy testing is being conducted by highway departments and mapping engineers to determine the adequacy of present specifications. At present most photogrammetric mapping specifications are based on the National Map Accuracy Standards. As applied to maps at a scale of 1 inch = 40 feet, these standards provide that not more than 10 percent of the points tested shall have a horizontal error exceeding 0.033 inches. As applied to the vertical accuracy of a 1-foot-contour-interval map, the standards provide that not more than 10 percent of the elevations tested shall be in error more than one-half the contour interval, or six inches.

The basic field work necessary to assemble and complete a topographic map at a horizontal scale of 1 inch = 40 feet and a contour interval of 1 foot requires careful and intelligent location selection and field identification of all required control positions. A horizontal and vertical closure of one part in ten thousand is required to fulfill the aforementioned specifications.

The horizontal control must be accurately related to the pertinent State rectangular grid system. Horizontal control must be established by a traverse or base line, generally along the center of each route, with traverse points spaced at distances of 500 feet or less and marked by appropriate permanent monuments on the ground. Traverse points, with balanced coordinates, appropriate designations, and at least three reference points must be shown in detail on the map, together with all traverse lines, and balanced courses and distances. The vertical control survey must be related to mean sea level. Permanent bench marks must be established along the routes at intervals of not more than 2,000 feet, indicated in correct position on the map, and recorded with a complete description and adjusted elevation.

At the present time, Aero Service Corpo-

Presented at the 18th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 24–26, 1958.

ration is using the Kelsh plotter and the Wild A-8 Stereo-Plotter to complete the compilation of the base map. Thoroughly trained and experienced operators interpolate and plot all required information that is visible on the low-altitude photography flown over the final route selection. A very important consideration at the plotting stage is the use of an exceptionally stable material for compilation purposes. Two materials that have proven very satisfactory from a stability standpoint are a coated Mylar and a heavy 100-percent-rag paper mounted on aluminum foil.

The specifications for 1 inch = 40 feet topographic mapping for highway design work generally require the mapping of a strip 400 feet wide in urban or developed areas and a somewhat wider strip in suburban or undeveloped areas, plus such additional widths as may be required at interchanges, crossing eliminations, and similar structures. The maps shall include all physical topography, major subsurface construction, the property lines or roads, railroads, cemeteries, schools, parks and public buildings; major sanitary sewers, storm sewers, transmission lines, bridges, culverts (indicating type and size) and other structures. Pavements, curbs, surface drainage and wooded areas must also be shown.

Additional information and data must be included and shown in an area covering all proposed construction, generally a strip 300 feet wide centered on the proposed route center line. The construction-area mapping includes the indication of all property lines, with names of reputed owners; manholes and catch basins, with invert elevations; gate valves, hydrants, lighting standards, traffic signals, all drainage and sewer lines, water mains, gas mains and conduits (including size, type and depth below ground); the size and construction-type of buildings; location, surface and bed elevations of streams; bridges, railroads, streetcar lines, all utility poles and lines, fences, hedges, sidewalks, driveways; accurately coordinated and delineated street and right-of-way lines; pavement and rail locations, with elevations, at the sites of proposed bridges and railroad crossings. Elevations to hundredths of a foot must be given on existing bridges, including critical points of under clearance, on pavement and rails at the sites of all proposed bridges, and on the first floors and cellar bottoms of buildings.

The above-mentioned requirements make it necessary to conduct a very detailed and careful field completion and edit operation. Information must be gathered from various sources and then verified if possible on the ground.

Copies of the map compilation are used in the field to determine the location of all property lines. Existing information must be gathered from a number of different sources including the early warranty surveys filed with the State, the State Highway Department, the County and City Engineer Offices, the County and Township Assessors' Offices and the local realtors. This information is compiled and verified by a visit to the various properties. Whenever necessary, the up-to-date deed description is plotted and tied to definite property lines and corners as they exist on the ground and appear on the aerial photography.

A legend of fine-line symbols is used on the final map presentation to indicate the property conditions and property-owner names. The property lines must be accurately positioned for land-evaluation and acquisition purposes. The symbolization must be carefully executed so that all information will be completely clear and legible, and must be designed so that it will not interfere with the positioning and symbolization of utilities, planimetric detail, and contours that must be shown.

The gathering of all existing information on utilities including sewer and water lines is a time-consuming task. Various agencies must be contacted and visited to obtain construction drawings and any other information needed to position and completely describe each utility. The various records must be correlated with the plotted position of visible detail such as sewer outlets, pavement lines, curb lines, sidewalk lines, and utility poles. Considerable difficulty is quite often encountered in trying to obtain records of sewer lines and water lines as constructed. This information, usually

found in the city engineer's office, is sometimes lost or destroyed, necessitating extensive investigation on the ground. The various utility companies, including the telephone, electric power, gas and pipeline companies, are generally very cooperative in furnishing all available data, especially when the planned construction is likely to affect or disturb their installations and equipment.

The horizontal position of all utilities must be carefully determined and drafted on the compilation and the final sheets to be delivered to the client. The drafting of the various utility symbols and the description of the number, size, and type of wires on all aboveground and underground telephone, telegraph, and power lines must be skilifully styled and located. The problem of indicating several types of utilities located one on top of the other becomes quite complicated even on a map at this relatively large scale.

Information concerning the depth of all underground facilities and structures is obtained from existing records and supplemented with necessary field measurements. Elevations of sewer inlets and outlets quite often are difficult to obtain in the field because the manhole covers have been buried as a result of changed grading and paving lines. The basement-floor and first-floor elevations of all buildings, elevations of tops of sanitary and storm sewers, as well as pavement and rail locations and elevations are obtained by field survey and indicated on the map.

The final phase of field-survey operations is the establishment of a centerline profile and secondary profiles on all cross streets. Cross-sections are established at 50-foot intervals along the center line and range in length from 400 feet to 600 feet between interchanges and from 600 feet to 1200 feet at the interchanges. The horizontal position of all profile and cross-section stationing is plotted and symbolized on the final map sheets. The cross sections are generally plotted and inked at a scale of 1 inch = 10 feet on standard federal-aid cross-section sheets.

The field-completion operation also includes the inspection of buildings for the purpose of classifying them as to type and size. Fences, walls, culverts, and bridges are inspected and classified according to specifications. A system of color and number coding has been devised to catalogue and classify all information that is to be compiled and displayed on the final sheets.

Present specifications require that the final product be delivered on tracing cloth, in sheet form ranging in size from 30 inches to 40 inches wide and from 12 feet to 20 feet in length, including a complete list or legend showing all symbols appearing on the map.

All information concerning elevations is of prime importance to the design engineer and must necessarily be accurately plotted at the compilation stage and carefully traced at the final-drafting stage. Contours must be plotted so as to indicate correctly and clearly the position of the crown of the road, the direction of grades at curves and intersections, the locations of gutters, and the heights and shapes of curbs as accurately as it is possible to indicate these at a scale of 1 inch = 40 feet. The heights of various types of ground cover and vegetation is considered when contouring the ground.

The final drafting and editing of a topographic map of this type can be successfully accomplished only by the help of competent people who have considerable experience in large-scale mapping, and who have the ability to style and fit together all of the horizontal- and vertical-control information, utility information, and topography on one map sheet.

General Drafting Celebrates 50 Years of Mapmaking

By PAUL B. LEE

GENERAL DRAFTING CO.

WITH A DRAFTING TABLE borrowed from a former employer, a young Finnish immigrant who had been in the United States only two years opened a "public drafting room" on lower Broadway, New York, 50 years ago. From this modest beginning, General Drafting Co., Inc., has grown to be one of the three principal road-map makers in the United States. In 1958 it issued more than 30 million maps, in addition to other publications.

This year General Drafting is observing its golden anniversary. To celebrate the event, the firm has published a 64-page souvenir book. Entitled "Of Maps and Mapping," it briefly describes the history of mapmaking, outlines General Drafting mapmaking methods, and details the effective use of maps and related publications in advertising and public relations.

The book's illustrations include reproductions of some of the earliest maps known, as well as some of General Drafting's latest products. There are many views of the company's unusual home office, a 42-room mansion patterned after a 16th-century English Tudor manor house. This "Castle," located in Convent Station, New Jersey, has been General Drafting's headquarters since May 1952. The firm's move from downtown Manhattan to semirural surroundings was the result of a long search for quarters which would be conducive to quality map making.

General Drafting was founded in 1909, by Otto G. Lindberg, who came to America at the age of twenty-one. He had studied engineering for two years in the Technical University at Helsingfors, Finland. After two years spent in various odd jobs, Mr. Lindberg decided to go into business for himself and opened a small drafting office at 170 Broadway. Although it was a one-man operation, he called his business "General Drafting Company." The firm was incorporated in New York in 1914 under this name.

Entrance to General Drafting's "castle" at Convent Station, N. J. This Tudor-style, 42-room mansion was easily adapted to the company's needs for mapmaking facilities.

During its early years, the fledging firm offered the services which its name implied: general drafting. Almost any work that required drafting or fine lettering was undertaken. Mr. Lindberg traced engineering drawings, plotted maps from field notes, and made geological and mining maps. He made five small road maps for *The American Motorist,* a publication of the American Automobile Association. In 1912, he drew, for the American Automobile Association, a map of Vermont, which was the first pub-

lished road map of that State. "Every stroke on it was made with my own pen," Mr. Lindberg recalls, "and what a terrible looking map it seems to us, today."

This chance venture into road-map making gave him an idea. Automobiles were coming into wider use, although motoring in those goggle-and-duster days was mainly a rich man's hobby. As a motorist himself, Mr. Lindberg had discovered that most existing road maps were inaccurate and hard to read. Moreover, they were usually sold to the motorist. Why not design and produce accurate and legible road maps and give them away?

He was able to interest the First National Bank of Boston in the idea. The bank ordered a road map of Massachusetts and mailed a free copy to every car owner in the State. Mr. Lindberg next approached the Standard Oil Company of New Jersey and offered to prepare a road map of New Jersey with the understanding that if it was not the best road map the company had ever seen, they need not buy it. Standard bought it and distributed 280,000 copies. The map, published in 1923, was the first ever produced in two colors by offset lithography. It was also the first road map to show principal routes in red, and roads under construction with broken lines. Unusual attention was given to the selection of pleasing and distinctive type for place names. Carefully chosen population symbols gave a quick key to the relative size of communities.

The New Jersey map was so enthusiastically received by the motoring public that Standard Oil ordered similar maps of other States in its marketing area. Thus General Drafting was firmly established in the road-map business.

Esso Standard Oil Company is still one of General Drafting's major clients. In addition to a series of road maps covering 18 States from Main to Louisiana, cruising guides and other special-purpose maps, General Drafting designs or produces for affiliates of Standard Oil Company (New Jersey) maps of New Mexico, Texas, Canada, Mexico, and various countries in the Caribbean, Central and South America, Europe and Africa. A series of road maps of the Southern States is produced for Standard Oil Company (Kentucky). Recently General Drafting has published maps of Ceylon and Hong Kong for Standard-Vacuum Oil Company.

In addition to road maps for oil marketers, General Drafting prepares maps and other types of travel literature for airlines, automobile clubs, manufacturers, public agencies, and a variety of other clients. In 1926, General Drafting pioneered with the opening of the first free oil-company touring service. This service was established to provide up-to-the-minute travel information for motorists, and is operated for Esso Standard Oil Company in New York, Washington, and New Orleans. A similar service is maintained for Standard Oil Company (Kentucky) in Louisville.

General Drafting also operates Imperial Esso Touring Service in Toronto, Canada, for Imperial Oil Limited, and Esso Touring Service offices in Paris and Brussels for a group of Esso affiliates in Europe. These seven offices answer more than 1,500,000 inquiries a year. They provide individually marked maps showing the fastest or most scenic routes to anywhere in the United States, Canada, Mexico, Central or South America, the Caribbean, Europe, and North Africa. In addition, they provide information on construction along the routes, places of interest, and other useful information. The European offices are equipped to answer inquiries in nine languages.

More than 14 per cent of the queries require individualized answers. One motorist asked the touring service to "suggest places within 250 miles of Parkersburg, W. Va., where marriages are performed without any waiting period." Another, seeking a route from New Orleans, La., to Winona, Minn., to pick up several cows, pleaded: "Please plan with the cows in mind."

In 1933 General Drafting produced its first four-color road maps. Another General Drafting "first" was the introduction of the pictorial map in 1936. These maps present full-color thumbnail sketches of travel attractions, products, events, or historic facts. In most cases the attractions

are described briefly in accompanying text which lists hours and admission fees. These maps have an unbelievable appeal. For example, the visitor's register at the Colt Museum in Hartford revealed that nearly half of their visitors were drawn there by the illustration on a General Drafting pictorial map.

Besides maps, the company has produced varied related literature, such as educational cartoon books, telling the stories of maps and roads, and travel-promoting newspapers and booklets for oil and banking industries.

Map production at General Drafting begins with the compilation of data, the assembly of large-scale official base maps, including U. S. Geological Survey sheets; State, county, and municipal engineer surveys; traffic studies and other source material. These are supplemented by reports from highway engineers and on-the-spot observations of company personnel who drive many thousands of miles annually in checking highway data.

The base maps are reduced photographically on film to the scale of the drawing to be made. The film is then carefully fitted, by cutting and mosaicing if necessary to an accurate map-projection drawing. It is then photgraphically "blue-lined" upon the projection, forming a base for the "dummy" or first draft. This draft, while hand-lettered, is highly accurate. The data blue-lined is judiciously edited and the result includes all currently available data which will appear on the printed map. Information is drawn from many other sources to supplement the base maps. These include postal and railroad guides; census reports; and publications referring to parks, airports, places of interest and to many other types of information included on a modern road map.

After the "dummy" is completely inked and lettered, and has been checked inch-by-inch for accuracy, it is photographed on film. Only the information which was inked in black by the editor comes up on the film. This is used as the base for a second "blue-line," upon which the final draft is executed. In this draft, every line and symbol shown on the "blue-line" is inked with great precision and the type is carefully placed. The selection of styles and sizes of type and its skilled arrangement on the map continue to be a phase of map making to which General Drafting devotes special attention.

When the final draft is completed, it is again checked line-by-line for accuracy, up-dated for recent developments, and reviewed for possible improvement by a quality-control group. Meanwhile, another group of artists and editors has prepared such elements as covers, pictorial maps, and text. Through their efforts, human interest is added to the cartography, the product is made more attractive, and travel stimulants are included.

As the reproduction of multicolor maps is a highly specialized and difficult operation, General Drafting does not undertake it. It does, however, select highly skilled lithographers who work to its exacting specifications and, on each map, it pursues a quality check of plate-making, color separation, and printing. In this way the high quality of the map is maintained throughout its reproduction.

Death of a Town

Like "poor Weary Waggles" the town of Elkins, Va., a marketing stop on the Washington and Old Dominion Railroad which was abandoned about thirty years ago, "is no more."

Despite the fact that Elkins, with a population of one in 1940, had grown to six times its former size before the axe fell, Elkins is doomed. Virginia authorities have ruled that the town does not exist and the Rand McNally atlas will remove all traces of the town from its pages.

The town is dead! Long live the town!

A Proposal for Standardization of Scales of Maps in Cartography

By B. GOUSSINSKY

CHIEF GEODETIC ENGINEER AND MATHEMATICIAN, SURVEY OF ISRAEL

MAPS are published for various purposes, and accordingly are prepared on different scales. It should, therefore, be desirable, from the point of view of rationalization, to have all the commonly used scales in one scheme. The scheme itself, on the other hand, to be rational, must be based on one binding governing principle, showing a uniform mode of derivation of scales from one another. The function of the scheme will be to serve as a central pool for the selection of scales. Scales not shown in the scheme are excluded from use. The scheme must also be sufficiently pliable and rich in variety, so as to be capable of satisfying all requirements. Strictly speaking, it is not the scale which is to be standardized, but the principle upon which it is based.

The achievement obtained by accepting such a scheme would be uniformity of scales of maps prepared for definite purposes—for the benefit of map users all over the world. A geodesist interested in gravity observations would be able to consult the necessary maps from different countries, all drawn on the same scale. The same applies to geographers, statisticians, etc.

The commonly used principle of derivation of scales is the one of duplication, which consists in multiplying the scale by the factor 2. According to this, a map on a certain scale, when reproduced on a double scale, transforms one map into four sheets, each of them the size of the original map, and all of them together covering the area of the original map. It is one of the conditions of uniform derivation, to have the derived series of sheets covering the whole of the original area, each sheet being of the same size, and, if possible, in the same form as the original map. One factor of derivation, however, is insufficient to render the scheme to be of real use—and it is necessary to introduce an additional factor or factors.

The only such factors that may come into consideration are 3 and 5. The rest of the possible factors are either uncommon numbers, such as 7, 11, 13, etc., seldom used for derivation, or composite numbers, such as 4, 6, 8, 9, 10, 12, etc., which can be resolved into the prime factors of 2, 3, and 5. The adjunction of both the factors 3 *and* 5 is impossible, because 2 and 3, on one side, and 2 and 5, on the other, are the bases of two different systems of numeration; the duodecimal and the decimal, respectively. The adoption of the two factors in one scheme would result in the absence of the very harmony which is sought as the solution of the problem.

Suppose that a map on a 1:10,000 scale is to be enlarged three times. The number of resulting sheets will be 9, but the new scale will then assume the form of 1:3333.33333. . . , which is certainly not an explicit form for a representative fraction of a scale. If the new scale is to be 1:3,000, the distance on the ground represented by a side of the sheet will be 3.33333. . . times less than that covered by the corresponding side of the original map. This shows that the combination of factors of the decimal and the duodecimal systems is undesirable, if not impossible.

We have to choose one of the two systems and this, by overwhelming considerations, will be the decimal, as the one which is our system of numeration. Adoption of one factor, e.g. 2, would result in a one-dimensional scheme, with all scales ar-

Presented at the Second Convention of Scientific Societies, Association for the Advancement of Science in Israel, Jerusalem, July 14–17, 1957.

1:10M	1:2M	1:400,000	1:80,000	1:16,000	
1:5M	1:M	1:200,000	1:40,000	1:8,000	1:1,600
1:2,500,000	1:500,000	1:100,000	1:20,000	1:4,000	1:800
1:1,250,000	1:250,000	1:50,000	1:10,000	1:2,000	1:400
1:625,000	1:125,000	1:25,000	1:5,000	1:1,000	1:200
	1:62,500	1:12,500	1:2,500	1:500	1:100
		1:6,250	1:1,250	1:250	
			1:625		

5

2

10

FIGURE 1.

ranged in a horizontal row or a vertical column. Each scale would then be twice as large or twice as small as the one adjacent to it. The use of two factors necessitates a two-dimensional scheme, as shown in Figure 1. The scheme is arranged in a grid form of horizontal rows and vertical columns. Horizontally the derivation factor is 5, and vertically it is 2. The factor in the direction of the main diagonal is 10.

In general, a scale, unless it is situated on the basic horizontal or vertical line, is obtained by using both factors. It is easy to note that, when proceeding in one direction only, the scales become numbers inconvenient for us, that is, starting from the scale of 1:1,000,000 we obtain two series of scales.

(1) 1/1,000,000, 1/500,000, 1/250,000, 1/125,000, *1/62,500*
(2) 1/1,000,000, 1/200,000, 1/40,000, 1/8,000, *1/1,600*

The last two scales in both series are inconvenient for use. It is obvious that, in order to have favorable distribution of scales in a serial map production, both directions must be used.

Herein lies the important feature of the scheme. Due to its bi-dimensionality it gives the possibility to pass from one factor to another whenever found necessary. The basic scale from which derivations start in the two directions is the 1/1,000,000. Scales shown within the thick frame cover the usual range of scales for maps and plans. Other scales can easily be extrapolated on both sides of the border.

Figure 2 shows a sample scheme of scales for a medium sized country. Scales in the same row or column, shown in thick frame, represent either alternatives or simultaneous existence, as means of transition from one row to another. Thus, the scales of 1/2,500 and 1/2,000 can be excluded

A	B	C	D
1:250,000	1:200,000		
	1:100,000		
	1:50,000		
	1:25,000	1:20,000	
		1:10,000	
		1:5,000	
		1:2,500	1:2,000
			1:1,000
			1:500
			1:250

FIGURE 2.

from each other so as to have the regional series of maps starting with 1/20,000 to finish with 1/5,000, without having any such maps on the 1/2,500 scales. On the other hand, we can have also the two scales existing side by side, with 1/2,500 as the last in the regional series of maps, and the 1/2,000 as the starting smallest scale in the cadastral series of plans.

While the manuscript for the above paper by B. Goussinsky was being marked for the printer, it was discovered that the same paper had been published in the *Empire Survey Review*, No. 109, Vol. XIV, July 1958, pages 298–301. However, because of the very slight overlap between readers of the *Empire Survey Review* and SURVEYING AND MAPPING, it was decided to proceed with the publication of the paper in our Journal.

—EDITOR

New Automatic Translator Converts Terrain Information to Digital Data

A problem in aerial surveying and mapping is the cost of engineering man-hours required to convert topographic information to data in a form in which it may be used in computing.

A West Coast manufacturer of electronic equipment has designed an electronic device—that automatically translates terrain measurements from aerial stereophotographs to digital data ready for input to the computer—for Pafford & Associates, Los Angeles surveyors and mappers, who report achievement of the hoped-for reductions in the number of engineering man-hours per project.

In operation, a two-dimensional map of a stereomodel is drawn with a tracing table. The map is scaled and oriented to the stereomodel, and a dot of light on the plotting table is made to follow the desired section on the surface of the model. Elevation over any part of the section can thus be read and automatically recorded in digital form as two-axis output in the form of paper tape, punched cards, or remote control typewriter when the "record" button is pressed.

The device is now in production and is available.

Confusion of Tongues

The following is copied from *The Peninsula Gazette* Vol. 5, No. 44, November 4, 1958, a weekly, mimeographed, newspaper published at Winter Harbor, Maine, under the editorship of Bernice Richmond. The initials "C. F. M." at the end of the item are those of Carroll F. Merriam, Past President of the American Congress on Surveying and Mapping, now retired and living in Prospect Harbor, Maine.

—EDITOR

Many people wonder why I cannot give a direct answer to a question frequently asked, "Where can I get *geodetic* maps?"

All properly constructed maps covering an area of more than a few miles square could be considered *geodetic* maps because, depending upon the use to which the map is put, the curvature of the earth has been considered either directly or indirectly. I first have to inquire what kind of a map the questioner has in mind. In most cases, it can be boiled down to one or two things, either he wants a chart published by the Coast & Geodetic Survey or a topographic quadrangle sheet published by the Geological Survey. The former shows soundings and aids to navigation together with sufficient of the coast to identify landmarks as seen from offshore, whereas the latter covers land areas and shows nothing below the surface of the sea and lakes.

The similarity between the words "geological" and "geodetic" leads people to confuse two distinct government services. For clarity, they may be regarded this way. It is the Coast & Geodetic Survey which not only makes charts for the mariner but among other duties establishes the framework for all maps. Based on this framework the Geological Survey and other agencies complete maps of land areas. Most commonly known are the standard quadrangle sheets of the Geological Survey. These are stocked by J. A. Thompson and Westcott's Hardware, Ellsworth. Charts of the Coast and Geodetic Survey may be obtained from Frenchman's Bay Boating Co., Bar Harbor; F. T. Brown, Northeast Harbor; or from Manset Marine Supply Co., Southwest Harbor.

C.F.M.

Surveying Education

By JESSE E. FANT

ASSISTANT PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF MINNESOTA

NUMEROUS ARTICLES have been devoted to the status of surveying and mapping instruction in the universities and colleges throughout the United States. The concensus of opinion indicates that because of the expanding subjects in the field of civil engineering there is less time available for the teaching of surveying and mapping; consequently, the student is not as well prepared in this field as he has been in the past. How this decreased emphasis affects the surveying and mapping profession and how best to train experts in this field is open to much discussion and study. It is not the intention of this paper to offer a solution to this problem. It is intended to give a short summary of the evolution of the surveying courses at the University of Minnesota from 1946 to 1958 and to present the philosophy of the administrators which resulted in the curriculum changes. An attempt will be made to explain the philosophy of the surveying teachers as to how the revisions of the courses changed the final aim of the surveying courses.

Prior to 1946 the University of Minnesota offered a four-year curriculum in the Institute of Technology leading to a Bachelor of Science degree in Civil Engineering. The curriculum in the Civil Engineering Department and, specifically, the courses in surveying and mapping had been the same for several years. The three surveying teachers had operated as a team for over 20 years and all of these men were to retire by June 1948. There were three courses offered in the sophomore year and five courses offered in the junior year related to surveying of railroads. These railroads courses are included since they contained the route surveying and spiral curve instruction. The students also attended a six-week, summer, surveying camp after their junior year. Three elective courses, Cadastral Surveying, Errors of Surveys, and Methods of Computation completed the series of courses offered prior to 1946. In summary, the students received 80 hours of lecture and 430 hours of field or laboratory work, not including summer camp.

Surveying was also taught, staffed with their own personnel, in the departments of Mining Engineering, Forestry, and Agricultural Engineering. Surveying, particularly the sophomore courses, was taught at several colleges throughout the State of Minnesota. This was necessary so that students entering these colleges for pre-engineering training could enter the University of Minnesota in their third year as regular students.

In the fall of 1946 the University of Minnesota adopted a five-year curriculum in the Institute of Technology. Under the new curriculum the surveying courses remained the same until 1952. From 1946 to 1952, the first surveying courses were still being taught in the sophomore year and were the only courses in the Civil Engineering Department offered to sophomores. The retention of this series of courses (basic courses in the other departments were also taught in the second year) in the second year forced the colleges throughout the State to provide staff, techically trained to teach these courses, if they were to retain their pre-engineering students for two years. The colleges had difficulty obtaining staff to teach these basic courses in engineering and a more difficult time finding enough students for these courses. This situation led to the adoption, starting in the fall of 1953, of a common two-year curriculum for all students entering the Institute of Technology. This change in curriculum required each department to revise its curriculum to provide space in the last three years for the basic courses previously taught in the second year. In the Civil Engineering Department this called for a major change in the surveying courses.

By 1953, after six years experience in

teaching and supervising the instruction in the field of surveying, it seemed to the new staff that too much time was being spent on the practical aspects of surveying and that it was difficult to keep the students and the staff interested in surveying. The logical conclusion was that the instruction in surveying was top heavy in field work and that, with a reduction in the field work, the material could be presented in one year. Since the last three years of the curriculum were full anyway, no one objected to the elimination of one year of the surveying sequence to solve the problem arising from the common two year curriculum. The remaining five courses in the third year were studied and revised.

After some study, a one-year sequence of three three-credit courses was retained in the third year, consisting of two lecture hours and a four-hour laboratory period per week.

Curriculum	Hours	
	Lecture	Laboratory
Old	80	430
New	60	120

This revision constitutes a reduction of 25 percent in the lectures and a 72-percent reduction in the field and laboratory time. The reduction in the lecture time was not considered serious for three reasons: (1) the two lecture hours are separate from the laboratory time, requiring the instructor to prepare and give two lectures per week; (2) some lecture is given in field demonstrations and laboratory periods; and (3) some of the previous lecture material is given during the present, five-week, summer camp which all civil engineering students are required to attend.

Under the old schedule of classes the lectures were given in the first hours of two four-hour laboratory periods per week. It was very tempting on beautiful fall days to get the students in the field with a very short lecture. It was also easy to go to class well prepared to instruct the students in the laboratory problem but not have a full hour of theory prepared. The lecture time, though reduced under the new curriculum, covers essentially the same material that was previously taught. The concentration of the lecture material requires the student to do more home work and keeps him more interested in the course.

The major reduction of the laboratory time required a change in the thinking of the staff as to what should be accomplished. It was decided that the laboratory periods should supplement the lectures and long practical problems should be eliminated. The students perform taping problems, measure angles, run levels, set slope stakes, run a simple curve and spiral, and make stadia observations—but only until they learn the proper field procedures by practice or demonstration. No attempt is made to make them qualified field men as to their speed of operation. This can only be accomplished with extensive practice. They do become more proficient in field operation following the five-week, summer camp but even here more emphasis is being placed on their knowledge of theory and the proper application of this theory.

The material offered in the three courses has been changed somewhat each year since 1953 to make better courses (more related material in each course) and to better present the material. In 1955 the administration decided that several divisions of surveying were unnecessary and uneconomical. After consultation with other departments that offered surveying, it was decided that one common series of courses be offered, and all students needing surveying instruction could take all or part of the series.

The students taking these courses at the present time are:

Fall Quarter C.E. 18	*Winter Quarter C.E. 19*	*Spring Quarter C.E. 20*
Civil Engrs.	Civil Engrs.	Civil Engrs.
Mining Engrs.	Mining Engrs.	Mining Engrs.
Agr. Engrs.		Agr. Engrs.
Geologists		

The three courses are separate and reasonably complete so that a student can have a working background of surveying if he takes only one or two courses of the three. The fall-quarter course, control surveys, covers theory of measurements, taping, instrumentation, orientation, triangulation,

traverse, level circuit, and triangulation adjustments. The winter-quarter course, route surveys, includes simple, spiral, and vertical curves, cross sections, earthwork, mass diagram, and construction staking. The spring-quarter course, includes boundary surveys, subdivision design, topographic mapping (all methods), and construction surveys except those related to route surveys. No field problems are attempted in the winter quarter and the students stake curves in the laboratory periods in the spring quarter. The Argicultural Engineering students are tutored by the instructor in the basic theory of curves so that they have some knowledge of the field problem.

In a combined curriculum special subjects related to specific fields cannot be included in the course material. Mine surveying, farm drainage surveys, extensive planetable practice, etc., must be left to the departments to be taught as advanced courses, included in other courses, or taught at summer camps or on field trips. Some of the subjects that are taught at the Civil Engineering Summer Camp, that are not taught in the basic curriculum are, stream gaging, lake sounding methods, string lining, star observations for latitude and longitude, solar and Polaris observations for azimuth, turnout problems, and precise leveling. These subjects seem more alive when the student can immediately practice the principles as outlined in the lectures. For those students who desire more advanced training, three elective courses are offered for those who have completed summer camp. These courses are Geodetic Surveying, Photogrammetry, and Land Surveying. Elective courses can be revised and new ones initiated as the demand changes with the times. The courses at Minnesota seem to satisfy the demand in this area.

As this combined curriculum was taught and revised over several years no textbook could be found that presented the material in suitable form. Essentially the material covered in the three basic courses is that material found in a standard surveying and route surveying text but in abbreviated form. The assignments had to be reduced to portions of chapters, resulting in a discontinuous presentation of the material. Some confusion resulted in that the other departments were not clear on what was being taught in the combined courses. As a consequence, the author prepared his lecture notes for the first-quarter course and these notes are being used as a text. For the winter quarter the students will buy a route-survey text. It is hoped in the future that a complete text will be found that is suitable for the entire series of courses.

The combined curriculum has reduced staff and equipment requirements; allows for more sections of each course, permitting more flexibility in staff and student programs; and more interested and qualified staff members teach the courses. The courses are becoming more theoretical to better fit the requirements of all departments, and it is hoped that the material will not become static. It can be foreseen, with the advent of electronic measuring equipment, computing machines, and related equipment the basic courses in surveying can undergo considerable changes in the next few years. These changes must be made if surveying and mapping are to remain in the civil engineering curriculum.

Universities and colleges are attempting to give the student a firm grasp of fundamental principles covering a multitude of subjects. The graduate should be able to understand a human or technical problem in his field, to review and study intelligently material relating to the problem, to think of possible solutions to the problem, to reason by experience or knowledge the best solution to the problem, and to organize and supervise the work necessary to achieve this solution. It is unreasonable to assume that graduation, per se, makes anyone expert enough to achieve the best solution to a problem without considerable study and experience after graduation. The graduate of Minnesota, who enters the surveying and mapping field has plenty to learn; he is capable of learning if his organization requires that he do so. Most organizations formerly felt that the graduate civil engi-

neer should be able to direct surveying work without additional training or study. Fortunately this philosophy is changing and the graduate is getting some training in organization requirements, accuracies, and procedures before he is turned loose with a field crew. This is as it should be.

In conclusion, since surveying and mapping (engineering measurements) are necessary for the proper planning, design, and construction of all engineering projects, the author believes that some training in this field should be given in all engineering colleges throughout the United States. This training should be theoretical and basic to all measurement problems. Each school should offer elective courses in this field to satisfy the demands of its area; and a few schools should specialize and offer degrees in surveying and mapping. Summer surveying camps are not necessary in all schools. However, this additional training is very necessary in some areas of the United States. The amount of required instruction in surveying and mapping is open to much discussion among practicing engineers, land surveyors, and teachers. No definite answer will ever be found.

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U. S.–Honolulu Air Chart

The first air chart, especially designed to meet the needs of commercial air carriers operating long flights over water between the United States and Honolulu, has recently been published by the Coast and Geodetic Survey.

The design of the new chart, Aircraft Position Chart 3096, was based on experience gained during the production of four similar charts covering other areas of the globe and on comments of interested airlines to insure that operational requirements would be fully satisfied.

Chart 3096 is unique among aircraft-position charts since it is the only one on the Oblique Mercator Projection. Most air charts are on conic or regular Mercator projections. The comparatively narrow route covered by the new chart is ideally suited for the projection used. It has the advantage of less scale variation along the normal routes of flight.

The only land areas shown on the chart are the seven main islands of the Hawaiian Archipelago and the west coast of the United States.

The chart is printed on one 24- by 42-inch sheet at a scale of 1:5,000,000. A lightweight paper is used to reduce bulk and make it suitable for filing as a permanent part of the flight record. Chart 3096 is distributed by sales agents located at most major airports, district offices, and the Washington office of the Coast and Geodetic Survey. Price 10 cents a copy.

Automatic Map Compilation

The following, from a news release dated December 15, 1958, cleared for publication by the Office of the Chief of Engineers, U. S. Army, is published in the belief that it will be of considerable interest to many readers of SURVEYING AND MAPPING.

—EDITOR

The United States Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia, has awarded a Government research and development contract to Paul Rosenberg Associates, consulting physicists in Mount Vernon, New York, for the design, development, and construction of an automatic map compilation system.

The system will automatically compile topographic map information from aerial photographs in much shorter time than is now required by conventional photogrammetric methods. The output of the system will be a fully contoured photomap in orthographic projection, corrected for distortions of relief and camera orientation.

The components of the system will include: flying spot scanner cathode ray tubes and optical systems to view the aerial photographs; a fully transistorized high-speed electronic digital computer; electronic correlation circuits to recognize corresponding areas on photographs and measure relief; special magnetic tape recording equipment to record terrain elevations; and special high resolution facsimile equipment to print the finished photomap. It is estimated that two years will be required to design, develop and construct the first laboratory prototype of the automatic map compilation system.

Optical Offsetting

By GEORGE E. KATTOUAH

SURVEYOR-ENGINEER, TRIPOLI, LEBANON

THE EFFECT of sloping ground on the direction of an offset should receive attention.

1. If the chain and tape be both laid on the slope, so that they are at right angles where they meet, then if either the chain or the tape be horizontal, the corresponding directions in the horizontal plane will also be truly at right angles to one another.

2. But, if both be sloping this will no longer be true.

In Figure 1, let OA be the chain line, at an angle α from the horizontal OB; and let

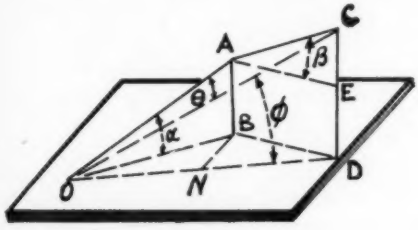

FIGURE 1.

AC be the offset supposed perpendicular to OA, but inclined at an angle β to its horizontal AE. OB and BD are the horizontal projections of OA and AC, and it is required to find the angle OBD which the horizontal projection of the offset should make with the chain line on paper for a correct result.

Because the angle is clearly independent of the lengths, we will assume:

$$OB = AE = 1$$

Then, $OA = OB \sec \alpha = \sec \alpha$

$AC = AE \sec \beta = \sec \beta$

Let $AOC = \theta$

Then, because $AOC = 90°$, we have

$$\tan \theta = AC/OA$$
$$= \sec \beta / \sec \alpha$$
$$= \cos \alpha / \cos \beta \qquad (1)$$

Now let $DOC = \phi$, OD being the horizontal projection of OC.

Then $\sin \phi = DC/OC$
$$= (BA + EC)/OC$$
$$= (\tan \alpha + \tan \beta)/OA \sec \theta$$

But $OA = \sec \alpha$

Therefore $\sin \phi = (\tan \alpha + \tan \beta) / \sec \alpha \sec \theta \qquad (2)$

Then $OD = OC \cos \phi$
$$= \sec \alpha \sec \theta \cos \phi$$

which gives the length of OD, since θ and ϕ are now known.

Lastly, in the triangle OBD, $OB = BD = L$. Hence, if N be the middle point of OD, $BND = 90°$ and we have:—

$$\sin \tfrac{1}{2}OBD = \tfrac{1}{2}OD \div L$$
$$= \tfrac{1}{2} \sec \alpha \sec \theta \cos \phi \qquad (3)$$

Knowing the slopes, we find θ from (1), then ϕ from (2) and, lastly, OBD from (3).

TABLE 1 shows the results for different slopes. The exact accuracy of the figures is not guaranteed but is sufficient to indicate roughly the amount of error. Values for further slopes could be calculated as explained above.

If both slopes (the chain and the tape) are of the same sign (both up or both down), the offset is to be plotted (on paper) at this angle from the back position of the chain line. But, if the slopes are of opposite signs, this angle must be laid off from the forward position of the chain line —to the right or left, as the case may be.

The length must also be corrected for slope of chain.

Values of α	*Values of β*				
	2° 52′	5° 43′	8° 08′	11° 19′	14° 02′
1/20 = 2° 52′	89° 51′	89° 43′	89° 36′	89° 26′	89° 17′
1/10 = 5° 43′	89° 43′	89° 26′	89° 11′	88° 51′	88° 36′
1/7 = 8° 08′	89° 36′	89° 11′	88° 50′	88° 22′	87° 58′
1/5 = 11° 19′	89° 26′	88° 51′	88° 22′	87° 42′	87° 08′
1/4 = 14° 02′	89° 17′	88° 36′	87° 58′	87° 08′	86° 26′

Second Coastal Geography Conference

The Division of Earth Sciences, National Academy of Sciences–National Research Council, is sponsoring, at Louisiana State University (Baton Rouge), April 6–9, 1959, the Second Coastal Geography Conference. The First Circular, announcing the Conference, lists titles of fifteen papers contributed by coastal specialists from some eight different countries.

Two of the Conference days are set aside for field studies. A general excursion will visit the coast most effected by Hurricane Audrey, June 1957. Other excursions, to points of interest on the Louisiana coast, are also planned.

Persons interested in the Second Coastal Geography Conference may request additional details from Dr. William R. Thurston, Executive Secretary, Division of Earth Sciences, National Academy of Sciences–National Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

WALTER W. RISTOW

Library of Congress

B.S.A. Merit Badge Booklet Revised

As a result of an item supplied by Gerald R. Hyde, Manchester, N.H., for the "Comment and Discussion" department of SURVEYING AND MAPPING[1] and published under the heading "Positively Misleading," Executive Secretary Walter S. Dix initiated action to have the questionable statement revised. We are happy to report that, owing to prompt action on the part of all concerned, it was possible to secure a revision of the material in time to meet a June 1958 deadline for a new printing.

The original booklet, one of the Merit Badge Series, was copyrighted in 1942 by the Boy Scouts of America, New Brunswick, N.J. The original author of this booklet was Professor George S. Hosmer. The booklet, 41 pages of text and illustrations, contained (pages 29–38) a chapter on "Transit and Level Jobs," and this is the portion that has been revised for the 1958 printing.

A credit note on page 38, inserted by W. Stanley Meseroll, Jr., Staff Editor of Boy Scouts of America Editorial Service, reads:

"The material is this chapter was revised in 1958 by Dan Harkness of the W. & L. E. Gurley Co., Troy, New York, and John B. Rowland,[2] of the Geological Survey, U. S. Department of the Interior. We would also like to extend our thanks to George D. Whitmore of the Geological Survey and Walter S. Dix of the American Congress on Surveying and Mapping for their help in having this material revised."

Also, an editor's reference footnote on page 32 of the revised booklet, referring to Surveyor's License*, reads:

"* Based on a compilation of State registration requirements for land surveyors prepared by Victor H. Ghent, Secretary, Property Surveys Division, American Congress on Surveying and Mapping."

The extremely fast action necessitated by the June 1958 deadline, facilitated by wonderful cooperation on the part of the Boy Scouts of America and those mentioned above, as well as the fine cooperation of the then ACSM President Robert H. Lyddan, past President Lester C. Higbee, and Professor Paul P. Rice of Rutgers University, plus that of ACSM member Gerald R. Hyde, who called the matter to our attention through the pages of SURVEYING AND MAPPING, made this important revision currently possible.

[1] *See* SURVEYING AND MAPPING, October–December 1957, Vol. XVII, No. 4, page 446.

[2] Assistant Editor, SURVEYING AND MAPPING.

Some Aspects of Map Usage and Map User Requirements

By W. D. HARDEMAN

STATE GEOLOGIST AND DIRECTOR, TENNESSEE DIVISION OF GEOLOGY

WE ARE ALL familiar with the tremendous increase in topographic map coverage in the United States. I believe that this has resulted primarily from the far-sighted, cooperative, matching-fund program which the Federal Government offers to State agencies through the Geological Survey.

Continually improving techniques by the mapmakers give us better and better topographic maps which in turn are more and more useful. Therefore, the subject of map usage and map user requirements has become so large and so varied that I should like to restrict most of my remarks to some of the very specialized uses and requirements of geologists.

Geologists probably use topographic maps in more different ways than any other professional group. In the first place, no really complete geological or mineral-resource study can be made without a topographic map, because a geologist deals almost entirely in three dimensions. I feel that the value of detailed topography is 25 to 50 percent of the final geological or mineral-resource report, depending on how familiar the geologist is with the rock units in the area before he begins the work. A detailed report almost always involves making a geologic map. This is a map that shows in detail the areas in which the various rock units or types are found beneath the ground surface.

In the construction of such a map the geologist must make a field study of the entire map area to whatever degree necessary to get the required information on the different rock formations. Therefore, it immediately becomes extremely important to him to be able, "by eye," to locate himself precisely everywhere on the map, but particularly where he succeeds in obtaining geological information.

NEVER SMOOTH A CONTOUR LINE

This brings us to the geologist's primary map user requirement—*that a topographic map represent as nearly as possible the exact surface of the ground.* We object to any smoothing of the contours, even though this might still allow the map to meet the required accuracy standards. Slight irregularities in the normal contour pattern are extremely useful in making locations in the field.

Along this line we are delighted to note that, in recent U. S. Geological Survey maps of the 1:24,000 series, bluffs are actually being shown as solid lines. This alone gives a geologist much valuable information on the character of the rock, contacts between different rock types, and the dip or inclination of the strata. It is also helpful if the details of bluff lines or escarpments are shown in their true, irregular, jagged pattern. Such features enable a geologist to determine the pattern of jointing or tensional fractures which are valuable in the search for potential mineral deposits.

The accurate spacing of contours to show "benches" on long slopes is extremely important to the geologist. Benches are held up by rock units which are more resistant to erosion than the overlying and underlying beds. These benches often reveal excellent outcrops of the rocks and are, therefore, areas that need to be examined in detail. The old method of spreading or spacing contours made it difficult for the geologist to locate himself and destroyed much valuable geological information. On detailed topographic maps, it is possible, in some cases, to draw quite accurate structural con-

Presented at the 18th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 24–26, 1958.

tour maps without ever leaving the office, by using the elevations of the tops of widespread benches.

Of course, we use all the features and culture shown on the map for location purposes. We find, for instance, that in Tennessee the green woodland overlay is very useful, especially in unpopulated areas and where the terrain is generally featureless. However, because contours naturally cover all of the map and because we must think in three dimensions, both as to where we are in area and as to the interpretation of the geology, contours are by far the most valuable of all the features shown on topographic maps. So, to repeat, from the geologist's viewpoint the most important rule for the mapmaker would be to *never intentionally smooth a contour line.*

TOPOGRAPHIC MAPS AND GEOLOGY

I should like to point out some examples of how topographic maps are used by geologists in our part of the country.

We are often able to detect faults or breaks in the rock strata by the resulting topography, which is sometimes an escarpment and sometimes a valley, depending upon the rock units involved and the drainage.

Hogback ridges indicate rock formations which are resistant to erosion, and these ridges show the direction and approximate degree of inclination of rock strata down the dip slope on the gentle side. Flatirons superimposed upon such a dip slope show the outcrop of additional resistant beds, usually of sandstone or limestone.

Folds in the rock strata, both up in the form of anticlines and down in the form of synclines, can often be determined from detailed topographic maps if the rock strata involved have differing degrees of resistance to erosion. This is extremely useful in the search for oil and gas and many types of mineral deposits.

Talus slopes of loose rock fragments are quite easy to spot because of their character as shown by detailed topographic maps. This information is useful in the application of engineering geology to the construction of highways or large buildings.

Stream patterns are extremely important, for they often give clues to rock formations upon which they are flowing. The joint or fracture pattern of horizontal rock formations is nearly always apparent, because the straight courses of the streams are controlled by these joints. A dendritic pattern usually indicates flat or gently dipping beds in areas of sedimentary rocks, while a trellis pattern nearly always indicates relatively steep-dipping beds with the long straight ridges being held up by the more resistant rock formations.

Karst or sink-hole topography shows the extent of certain types of limestone formations. Somewhat perched marshy areas are almost always underlain by an impervious clay or shale. Springs often indicate a contact between rock types, such as limestone or sandstone above and shale or clay below, and some such contacts can thus be accurately traced for long distances.

All types of geophysical maps are best shown and most accurately constructed on topographic bases. Structural contour maps showing the "topography" of the surface of a certain widespread rock stratum are made much more rapidly and accurately on detailed topographic maps, and these in turn are indispensable in the exploration for oil and gas and very useful in any type of mineral exploration.

Topographic maps are invaluable as bases for land maps to use in the acquisition or leasing of property. Oil and mining companies are often discouraged from exploration by finding no map coverage, but are always delighted to find detailed topographic maps available.

Ancient beach lines or ridges, which are now many miles from the present shore and much higher in elevation, can be interpreted on accurate topographic maps. These old beaches control exploration for heavy mineral sands, which are sources of such important metals as titanium, zirconium, thorium, and the rare earths. Terraces along present or abandoned streams can be located on accurate topographic maps, and such areas are valuable sources of supply for sand and gravel. All types of strip-mining operations are much simplified, both in exploration

and exploitation, by the availability of detailed topographic maps.

Accurate coal-reserve estimates are possible only by the use of such maps. Inasmuch as most of the important coal reserves are in relatively horizontal beds, a very accurate outcrop line can be drawn by using coal openings along with projected dip from other exposed rock formations. In Tennessee, for example, we have reappraised our coal reserves after about a five-year study, and we find that our true reserves are only about 10 percent of the original estimate, which was made many years ago by the U. S. Geological Survey without the benefit of detailed topographic maps.

PHOSPHATES AND FORTS

Tennessee has deposits of brown phosphate rock, in the central part of the State, which support a large chemical industry. The exploration for phosphate and the determination of minable reserves illustrate a rather unusual application of topographic maps by geologists. These residual phosphate deposits result from the chemical weathering of phosphatic limestone and directly underlie the soil mantle. Mining operations have shown that the best deposits are found on certain types of gently rolling hills and slopes in areas of relatively flat topography. The entire countryside is generally rolling topography, and exploration on this basis alone would necessitate an impossible amount of test drilling. However, when a detailed geologic map is made it shows the area underlain by each of a number of different limestone formations, only one of which, the Bigby-Cannon, is a source of the phosphate. This geologic map delimits exploration greatly but still leaves a very large area to be tested. But, if we superimpose the geologic map over topography and examine the belt of Bigby-Cannon limestone where it crosses these certain types of low hills, the more favorable areas of phosphate accumulation are readily apparent.

A rather unusual nongeological application of the interpretation of topographic maps can be made in connection with an interesting archaeological site in Middle Tennessee. This is called the "Old Stone Fort" and was probably constructed before 1400 A.D. It is described in several historical reports as a triangular fortified area of perhaps 50 acres, protected on two sides by river bluffs and manmade embankments and on the third side by a very large trench, some 1,500 feet long and 60 feet deep. It is very hard to understand how the Indians managed this excavation until one examines the new topographic map of the area. It then becomes immediately apparent that this deep "trench" is an old abandoned entrenched meander of the small river bordering one side of the area. The stream may have been flowing in this old channel when these fortifications were used by the Indians.

In this connection, it might be a good idea for our historians to become more familiar with the detailed topography of the sites of great historical events, so that they can more accurately describe and evaluate them.

CAN THE CUSTOMER READ THE MAP?

The Tennessee Division of Geology has for many years distributed to the public the topographic maps made by the U. S. Geological Survey. We now have available 643 different 7½- and 15-minute quadrangle maps in Tennessee.

We will also distribute the 1:250,000 Army Map Service series. This series should be very popular, because it fills a great need—that of a topographic map which covers a large area. It will be a wonderful accomplishment when the entire country is covered by such maps.

Records of sales of many thousands of the 7½-minute topographic quadrangle maps in Tennessee show that perhaps 50 percent are purchased by the professional user who generally knows what he wants and needs, and 50 percent by the layman for recreation or some other purpose. Therefore, perhaps we should take a careful look at how the average person uses a topographic map and at his map needs.

Our office serves hundreds of such topographic map users through personal contact each year. Some of you may be sur-

prised to learn that only an extremely small percentage of them understand contours and have any concept of three dimensions on these maps. Also a large number do not have any real understanding of scale. It is impossible for us to explain in five minutes what a topographic map really shows even to well-educated and informed persons.

This leads us to the conclusion that perhaps the most important general map user requirement is *basic understanding of a topographic map.* I find that usually only geologists and engineers have ever studied topographic maps, and that almost all of the other graduates of our colleges have never had a course that involves the use or understanding of topographic maps. In fact, I would be very much surprised if 50 percent of the college professors can read and readily interpret them. If our college professors and college graduates cannot read topographic maps, it is obvious that persons less educated usually will have even more difficulty in understanding them. I feel that the professional mapmaker and map user has taken for granted the ability of the individual to understand these maps. *The average person does not understand and is not able to read a topographic map.* Actually, topographic maps are quite complex, and it is not surprising that people with absolutely no formal instruction in the use of such maps, no matter how much other education they have, find it difficult to interpret these maps as they should.

If we think back to our first contacts with topographic maps, perhaps we will remember that it was rather difficult for us to visualize the concept of three dimensions and the scale of each particular map.

I believe that the understanding of topographic maps should be basic in our educational system and that the organizations and societies of professional engineers and geologists should encourage colleges and even high schools to include some instruction in the understanding of topographic maps as a prerequisite for graduation.

Only a map-informed and map-educated public will be able to fully appreciate and use the wonderful topographic maps which are now available for much of this country.

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International Congress of the History of the Discoveries

Under the auspices of the Portuguese Government there will be held in Lisbon, August 7–15, 1960, an *International Congress of the History of the Discoveries.* The Congress, which is to commemorate the fifth centenary of the death of Prince Henry the Navigator, will feature two themes, (*a*) the History of the Discoveries, and (*b*) Overseas expansion. A subsection on Cartography will be included in the first theme. Papers are invited for the Congress and should fall within the limits of the proposed themes. They may be written in Portuguese, Spanish, English, French, or Italian. Studies should not exceed 30 typewritten pages and should be received by the Secretariat of the Congress not later than March 1, 1960.

The Organizing Committee of the Congress is under the Chairmanship of Dr. José Caeira da Matta, with Dr. A. Moreira de Sá serving as Secretary-General. All correspondence relating to the Congress should be addressed to: Secretário-Geral do Congresso Internacional de Historia des Descobrimentos, Palácio de S. Bento, Lisboa, Portugal.

—Walter W. Ristow

Library of Congress

Texas A. & M. Data Processing Center

We learn from the *Texas Engineering Experiment Station News,* September 1958, that the Texas A. & M. College System is to have a new building to house its data processing center. The top machine in the new center will be an I.B.M. 704 digital computer, with eight times the capacity of the I.B.M. 650 which is currently the top machine at that institution. The new center will be under the direction of Robert L. Smith, Jr., who is now in charge of the existing data processing facilities at Texas A. & M.

Atlas de France

By G. ETZEL PEARCY

SPECIAL ADVISOR ON GEOGRAPHY, DEPARTMENT OF STATE

ORIGINS of the *Atlas de France* can be traced back to the middle of the last century when a group of scholars met to plan a *dossier graphique*. In it was to be shown by cartographic means the natural conditions and economic resources of the national territory of France. This early plan materialized in 1847 when a collection of maps appeared under the title of *Patria*. We may accept this publication as a forerunner of the present *Atlas de France*, although it left much to be desired because of the meager documentation and because of the overly small scale used for the maps.

Before the end of the nineteenth century three other publications appeared, representing even better attempts to put into map form the geographic aspects of France.[1] Not only geographers, but economists, sociologists, engineers, and astronomers were engaged in those enterprises, which without exception were sponsored by official bodies of the state.

The *Atlas de France*, as the national atlas is known today, dates back to 1914 when it was created in principle by M. Robert Perret. Six years later the *Comité National de Géographie* came into existence, and took over the atlas project. It was not until 1931, however, that the first sheets appeared, under the stimulus of the International Geographical Congress in Paris during that year. Meanwhile, in 1930 three prototype maps had been put into production: one to show relief, another to illustrate density of population, and still another to identify the location of certain minerals.

With such a tangible start, the *Atlas de France* came into being on a substantial scale and a complete volume of 84 plates was nearly finished in 1940 when wartime conditions interfered with the output of the final maps. Nevertheless, the work was successfully terminated in 1946 and the First Edition in its entirety came into being.

Sixteen years had been required to compile, draft, and publish the full complement of maps, which meant that the sheets first issued were already sadly out of date. World War II with its shock of occupation and readjustment took an especially heavy toll on those maps depicting the human geography of France. Further, techniques in the field of cartography had advanced since the 1930's, so the creators of the atlas realized that methods of production as well as content material would have to be revised in order to show up effectively. When the stock of the First Edition was exhausted in 1950 these shortcomings were taken into account. Rather than a simple reprinting of the atlas sheets, it was decided to publish a Second Edition which could incorporate the many fine features of the former work and at the same time take advantage of new techniques as well as more current data. In addition, a reappraisal of the table of contents would eliminate some of the weaker maps in favor of introducing new and more timely topics. In 1951 the way was cleared for the new project and work started on the Second Edition.

The Second Edition of the *Atlas de France*, still in production at this writing, is being issued in three parts, referred to in French as *fasicules*. The first two parts have already been publishel and the third is almost ready to appear. During 1958 the volume should be complete, though originally the schedule called for a 1955 terminal date.

Throughout its history the *Atlas de France* has had the sponsorship and cooperation of many of the most able geographers of the country as well as prominent scientists sym-

[1] In 1867, *Atlas physique de la France;* in 1876, *Atlas physique, politique et economique de la France;* and in 1879, *Albums de Statistique Graphique.*

pathetic to geography. Among the well-known names associated with the Atlas are de Martonne, Perret, de Margerie, Demangeon, Chabot, Gaussen, Sorre, Libault, and Majorelle. Of these Monsieur André Libault is presently concerned with the technical production of the Atlas and Monsieur Jean Majorelle with the administrative and financial aspects. The organization currently producing the Atlas is known as the *Société Française de Cartographie,* with headquarters deep in the Left Bank of Paris not far from the Sorbonne, at 121 Boulevard St. Michel.

FORMAT AND ARRANGEMENT

The format of the *Atlas de France* identifies the volume as of library size; a double page spread measures 19½″ × 25″. The plates themselves are held together by a heavy binding which is normally sold along with a subscription for the three *fasicules.* However, there is no reason why the individual sheets cannot be used and filed separately or by categories.

The compact shape of France proves ideal for arrangement on the plates. The country appears in many different dimensions, depending upon the nature and importance of the data shown. The majority of the plates fit into one of the sizes listed in the following brief tabulation:

SCALE	FORMAT ARRANGEMENT (*On the basis of a double-page spread*)
1:1,250,000	Four sheets for all of France (Northeast, Southeast, Southwest, and Northwest quadrants)
1:2,500,000	All of France plus two or three insets
1:4,000,000	Two maps of France, plus small insets
1:6,000,000	Six maps of France
1:8,000,000	Twelve maps of France

There are combinations of the above-mentioned arrangements, such as one map at 1:4,000,000 and several at smaller scales on a double-page spread. Also additional irregularity is introduced into the map pattern by regional maps, profiles, and other types of cartographic illustrations. There is adequate flexibility for showing all data pertinent to the geography of France, physical and cultural alike. By use of the scale at 1:1,250,000 it is possible, for example, to show in a generalized manner land forms region by region. On the other hand meteorological phenomena on a monthly basis can be well illustrated on maps at a very small scale, a dozen to a page. It is perhaps significant to note that from plate to plate the *Atlas de France* does not approach uniformity to any significant degree. There is a welcome absence of any long sequence of maps at the same scale covering varying types of data. Neither has any effort been made to provide complete coverage of the country in a series of very large scale maps.

ORGANIZATION OF DATA

In total the table of contents of the revised edition of the *Atlas de France* lists 82 plates, each of which is a double-page spread. Following is a skeleton outline of the organization:

I Physical Geography ..... 27 plates
  A. Morphology and Geophysical Science
  B. Climatology
  C. Hydrography
II Biogeography ..... 8 plate
III Economic Geography ..... 31 plates
  A. Agriculture
  B. Industry
  C. Commerce
IV Human and Political Geography 18 plates

As is characteristic of French geography, much attention is given to physical mapping. One series of four plates covers the relief of the country; another covers the geomorphology. In addition there are small-scale maps concerned with the geology, soil, and other expressions of the terrain. The French landscape is made up of a mosaic-like pattern of physiographic regions, each one of which has its own natural characteristics and corresponding human relationships. The complex pattern of these regions is shown in relatively great detail, each region in its proper perspective. Few Americans indeed would be able to distinguish the difference among such regional terms as Beauce, Brenne, Brandes, Bresse, Bauges, and Bessin, yet each one is rich in tradition and

to the French student of geography constitutes a definite type of countryside.

By the use of small-scale maps in series there is a good climatic coverage of France, with attention given to temperature types and aridity indices as well as measurement of actual annual, seasonal, and monthly climatic statistics.

The rivers and coasts of France mean much to the geographers of that country, and many studies on hydrographic features reflect the interest. In consequence the streams, lakes, and shorelines are amply illustrated by maps and supplemented with diagrams. For example, the rivers are shown in profile as well as by pattern of surface drainage. One plate shows the extent and time of floods. The bathymetry of lakes is shown at relatively large scales, and each coast is broken down into segments for featuring physical structure and surface characteristics.

Under the heading of biogeography is an array of natural vegetation maps in considerable detail, including special insets to illustrate types of plant life found along the littoral. Professor Henri Gaussen, one of the world's outstanding authorities on the mapping of vegetation, contributes the great part of this section. It is actually a generalized version of his large-scale mapping program on the vegetation of France at a scale of 1:250,000 in which color plays an important role in realistically depicting the vegetal landscape.

The thirty-one plates on economic geography do not depart markedly from those activities that typify gainfully employed Frenchmen. As one might expect, the plates include such topics as the distribution of vineyards, types of rural farming (examples of farm villages and land parceling), centers of tourism, and the network of inland waterways. One plate shows density of rail traffic and another comprises a series of insets of leading French ports. Each plate is individually prepared to best show the industry or activity at hand with no attempt toward uniformity from topic to topic as so often characterizes American and British atlases.

The final plates of the Atlas, on human and political geography, largely depicit cartographically the French census, including ethnic types and movement of population. In addition the structures of representative cities and villages are portrayed individually. The political theme in the section is somewhat limited, with plates only on administrative divisions and political opinion.

PRODUCTION

Only some 2,500 copies of the Second Edition are being printed. Selling at approximately sixty dollars (depending upon the binding selected by the buyer) the volume is too expensive for a heavy sale other than to libraries or large organizations. Actual sales are made on a subscription basis for the entire atlas; that is, fasicules or plates cannot normally be purchased individually. Oddly enough, more copies of the Atlas are sold outside of rather than within France.

The documentation of the maps consists chiefly of assembling material from official sources. The organization, *L'Institut National de la Statistique et des Etudes Economiques* (INSEE), provides a substantial proportion of the data used. The staff of the *Société Française de Cartographie* includes three or four well-qualified young people who gather and process the necessary material for the maps and graphic illustrations.

The finished plates are models of fine cartography. Some of the methods used in their production are no longer looked upon as modern, while in other instances the most advanced techniques come into play. Especially noteworthy are the distribution maps, with the myriads of dots and other symbols photographically placed and printed by an ingenious method devised by Andre Libault, Technical Director. The actual plotting of data on a plate is carried out in a lighted room and is recorded photographically on a similar plate in an adjacent dark room. This particular method of producing tiny symbols in a dense pattern would not be possible by conventional pen-and-ink technique. Likewise, names are placed on the plates photographically by a camera-like apparatus which is the forerunner of equipment used by the Army Map Service in

Washington and the *Institut Géographique National* in Paris.

Reproduction is slow. The final plates are printed on old flatbed presses. But the three technicians operating the presses are real craftsmen and spare no pains in making each plate come out to meet the highest standards.

SUMMARY

During recent years there has been a surge of interest in national atlases.[2] Many fine examples abound in which the geography of a country is presented in map form; each with characteristics reflecting the environment and culture as interpreted by leading cartographic entrepreneurs and technicians. However, the *Atlas de France* stands as a pioneer in the field, developed to a point where it can be considered as a classic. Cooperation among many of France's leading scientists and adherence to the finest traditions of academic discipline have combined over the years to produce the new Second Edition of the *Atlas de France* and make it a cartographic model of the national scene.

[2] "National Atlases: A Summary," Ena L. Yonge. *Geographical Review*, Vol. XLVII, October 1957.

Dimensions

Maps are featured in the Winter 1958 (Vol. 2, No. 1) issue of *Dimensions*, published by Lee Paper Company of Vicksburg, Michigan. It includes excellent reproductions of a Babylonian clay tablet, dated 2300 B.C.; Ptolemy's World Map, circa 150 A.D.; the 1507 World Map of Ruysch; the world map from the 1520 Strassburg edition of Ptolemy's Geography; Cassini's North Pole-centered world map of 1696; Captain John Smith's 1614 map of New England; Mercator's double-hemisphere map of 1587; and the Speed-Goos map of Bermuda, 1676. There are also photographs of an Army Map Service plastic relief map, and a portion of the Geo-physical relief globe.

The cartography issue, which includes a brief running text, was designed and edited by William Stone. To gain the width and flexibility for presenting the map reproductions a simple fold-out is employed.

"Mapping," the Editor rightly notes, "is a fine example of the marriage of art and science. The accuracy of the map is dependent on the surveyor and the mathematician . . . the beauty and clarity counts on the skill of the cartographer and artist."

WALTER W. RISTOW

Library of Congress

Humboldt Centenary

An International Commemorative Meeting, honoring Alexander von Humboldt, will be held in Berlin, May 18–19, 1959, on the hundredth anniversary of the death of the famous geographer and explorer. The meeting is sponsored by the Gesellschaft für Erdkunde zu Berlin (Berlin Geographical Society) in cooperation with other German scientific and professional groups.

The principal speaker, at the opening program on May 18, will be Dr. Carl Troll, Professor of Geography at the University of Bonn, Germany.

In further recognition of the occasion, the Berlin Geographical Society will publish a commemorative volume on Humboldt and his work, with contributions from scholars located in various parts of the world. Hermann Friis, Chief of the National Archives' Division of Cartographic Records, is contributing a chapter on Humboldt's six-week visit to the United States in 1804, including his association with Thomas Jefferson and with other members of the American Philosophical Society of Philadelphia.

Further information on the Humboldt celebration may be requested from Gesellschaft für Erdkunde zu Berlin, Potsdamer Strasse 11, Lichterfelde-West, Berlin, Germany.

WALTER W. RISTOW

Library of Congress

Professional Geodetic and Cartographic Literature in the Soviet Union*

IN RECENT YEARS, the editors of *Vermessungstechnik* have sought to give their German readers a survey of Soviet geodetic and cartographic works by means of reviews, articles, translations, and summaries. Although little was heretofore known about the activities of Russian geodesists and cartographers, there has developed a recognition of their tremendous and successful achievements in the 40 years since the Russian Revolution. Soviet literature has played an important part in this development, and it has been a major factor in the training and higher education of engineers and technicians through the promotion of new instruments and techniques as well as in the fulfillment of plans for political economy.

Before 1940 Soviet geodetic and cartographic literature appeared in a variety of publications. Overlapping and lack of uniformity in literary effort were unavoidable. The administration for geodesy and cartopography, therefore, established a publishing house for geodetic literature (Geodesisdat) in Moscow, where subsequently, the largest part of the technical literature on surveying and cartography has been published. Even during the war, the work was hardly interrupted.

Since 1956, this publishing house has been issuing the monthly periodical (*Geodesija i Kartografija* (*Geodesy and Cartography*) with an 80-page issue of 5,500 copies. Therewith it removes a deficiency which was felt by surveyors in increasing intensity from 1941 to 1955, when there was no such professional periodical. Previously there appeared only the *Geodesist*.

The new periodical has in a short time assured itself a large number of readers, and is read with interest in the peoples' democratic, as well as in capitalistic countries. Its primary objective is to aid in the fulfillment of the peoples' economic plans in the fields of surveying and mapping. Lead articles, therefore, present professional problems such as how the current work on the topographic surveys of 1:25,000 and 1:10,000 is handled and how new work methods are introduced. Since topographic surveys are principally based on aerophotogrammetry, most of the photogrammetric articles are concerned with ascertaining the best conditions and the improvement of equipment, materials, and procedures for such survey. Supplementing such studies are articles concerned with large installations, and works describing new optical distance finders with ranges up to 700 meters. In the field of surveying, there are considered such topics as the adjustment of large astronomic-geodetic nets, methods and adjustment of angle measurements, city surveying, etc. In cartographical articles there is interest in problems relating to the production of new maps, with especial reference to systematic procedures and new symbols.

Because Soviet readers are interested in scientific and technical developments in geodesy and cartography in foreign countries, the new periodical presents, in brief summary reviews, a picture of such developments as automatic horizontal leveling, Geodimeter measuring, the activities of the International Geodetic Association, relief representation on foreign maps, etc. Soon there is to be undertaken a systematic survey of the special techniques. Articles relating the improvement of teaching in colleges and technical schools, information about important technical developments, as well as book reviews, serve to broaden professional knowledge and information.

Although figures alone provide insufficient evidence for judging output, the 4,000 pages of the *Geodesist* printed between 1951 and 1955 do indicate the scope of works on geodesy. Of textbooks, generally between

* Translated and edited by Walter W. Ristow and Clara E. Le Gear, from an article by F. Deumlich in the November 1957 issue of *Vermessungstechnik*, Berlin.

5,000 and 10,000, and occasionally even up to 25,000, copies are issued. Professional publications (e.g., works of the Moscow Institute for Engineers of Geodesy, Photogrammetry and Cartography, and the Central Scientific Research Institute for Geodesy, Aerophotography and Cartography collection of articles on cartography) have editions of from 500 to 2,000. Illustrated works and instructions exceed 10,000 copies, and cartographic publications, depending on their importance, run to 300,000 copies (for instance the Atlas Mira).

Of recently published books, may be mentioned, in the field of introductory geodesy, "Geodesy" by Tschebotarjew, "Geodesy" by Schilow, and "Geodesy" by Densin; in the field of advanced geodesy and astronomy, "Selected Works" by Krassowski (4 volumes), "Precision Polygonometry" by Danilow, "Textbook of Advanced Geodesy" by Sakatow, "New Systems for Constructing Geodetic Grids" by Durnjew, and "Practical Astronomy" by Zwetkow; and in the field of photogrammetry "Photogrammetric Principles and Instrument Techniques" by Drobyschew, "Fundamentals of Photointerpretation and Photogrammetry" by Drobyschew, "Aerophotogeodesy" by Deineko, and "Aerophototopography" by Konschin.

Comprehensive works on large building installations which enable the engineer surveyor to proceed better than formerly include "Geodesy in Tunnel Construction" (2 volumes), "Geodesy in Industrial Construction" by Glotow, and "Location of Industrial Structures" by Ljutz.

Concerning the development and use of geodetic instruments, a series of small volumes has been published. In order to acquaint the youth with the lives and works of notable personages in geodesy and cartography, there has appeared a series of biographies on Struve, Zinger, Pewzow, Witkowski, Tenner, and others. A number of these works are known in Germany through reviews in *Vermessungstechnik* and through translations of the original works (namely, Danilow, Ljutz, Sakatow).

The low cost of these books is surprising. Textbooks with 300 to 400 pages cost about 4 DM. The printing technique and artistic execution until recently had not reached the state of excellence that is generally acceptable in Germany. Constant criticism and very recent developments indicate that this limitation will soon be overcome.

From the point of view of content, there are features which, to the German reader, would appear to be capable of improvement. There is, for example, the existing practice, common in many books, of a broad presentation of subject matter—the author in this manner displays his universal knowledge. There are the unnecessarily voluminous captions on illustrations, that uselessly fill space. There are—inasmuch as the subject matter is prescribed by the Ministry of Higher Education—books whose subject matter is almost identical (e.g., Geodesy) for similar works issued by different publishers with the same formulas and terminology. The Soviet geodesists objected to this and compiled, with the assistance of selected specialists and teachers, a four volume work "Geodesy" designed for geodetic high schools. For nongeodetic high schools, for topographical technicians and other specialists they plan to prepare additional books within the field of geodesy.

This publisher (i.e., Geodesisdat) has laid out a comprehensive program for the five year period 1956 to 1960. Of first priority is the preparation of books on subjects, considered important, which are nonexistent, bibliographically rare, or for which a revision is needed. The latter holds for "Advanced Geodesy" by Sakatow and Isotow, "Geodesy" by Tschebotarjew, "The Method of the Least Square and the Law of the Theory of Probability" by Tschebotarjew, "Gravimetry and the Theory of the Geoid" by Magnizki, Schimbirew, Schokin, and Brewer, and many others. Among photogrammetric works under consideration are "Photogrammetry" by Alexapolsi, "Aerophototopography" by Wesselowski, "Stereophotogrammetry" by Skiridow, "Aerial Surveying" by Scherschen, and "Aerophotography" by Michailow.

Later there will be textbooks on mathematical cartography, map editing and design, a handbook on engineering surveying (in five parts), books on industrial and

urban engineering surveys, works on organization and planning in the fields of topography, geodesy, and cartography, books about the construction of geodetic instruments and about interesting new problems, as well as instructions on plate making (for this some 500 copies are planned).

Interest in foreign works is indicated by the proposed translation and publication of "Ausgewählte Werke" by Gauss, "Kartentechnik" by Bosse, "Die Gaus-Krüger-Koordinaten" by Hristow, "Traite de Geodesie" by Tardi-Laclavère, "Physikalische Grundlagen der Aerophotogrammetrie" by Brock, and others.

A Jordan-Eggert-Kneissl type work "Geodasie und Kartographie" in 10 or 12 parts (up to 350 copies), will be compiled by a selected group of specialists. Articles, dissertations, patent notes, etc., in the fields of surveying and cartography, from all parts of the world, will be indexed with brief annotations (as in the Dokumentationdienst in the DDR, although not in card form, and without Dewey Classification numbers), and listed in the current issue of the USSR Academy of Sciences "Reference Journal, Astronomy-Geodesy." Each month there are listed here some 600 or 650 references on astronomy and between 150 and 200 on geodetic, photogrammetric, and cartographic subjects.

This summary report indicates that numerous works in Soviet literature, in the fields of surveying and cartography, are of value to the German Democratic Republic. True, all publications in the other branches of geography and climatology do not have the same relative interest. Many works, however, are worthy of note, and numerous others—especially in advanced geodesy—are outstanding.

By means of cultural exchanges and exchanges of teachers, assistants, and students, the interchange of literature and ideas is promoted. The scientific collections of the Technical High School in Dresden and the official surveying and mapping agencies possess numerous specialized works in the Russian language. Related to "Surveying" and in the category of Technical Press publications in Soviet literature are those of the Zentralstelle fur Wissenschaftliche Literatur, Berlin, monthly indexed series of translations entitled "Inhaltsverzeichnisse sowjetischer Fachzeitschriften" (Series IIIA)—quarterly subscription 3DM—and likewise that of the bi-monthly Dokumentdienst series "Geodasie" (Sponsor: Geodatisches Institut der Technischen Hochschule, Dresden) which are of noteworthy significance. Through the Dokumentdienst the contributors of surveying and cartographic works are, in a comprehensive manner, informed of existing literature in native and foreign sources, and get also a glimpse into Soviet literature.

For current information and scientific work it is necessary to see original works. The means for deriving the greatest usefulness of the Soviet geodetic specialized works are also available—which can add much toward the advancement of the sciences of surveying and cartography in the German Democratic Republic.

International Symposium for Distance Measuring Equipment

The American Geophysical Union has invited the International Association of Geodesy to hold a symposium on distance measuring equipment in Washington, D. C., May 5–12, 1959. This symposium is primarily for technicians who are interested in the development of such equipment and its application to geodetic and hydrographic surveying.

The technical sessions will be held in the Auditorium of the Commerce Building and the latest instruments used for this type of measurement will be exhibited in the Lobby of that building. It is expected that 50 to 75 delegates from other countries will attend. Persons in the United States interested in attending or desiring further information should write to C. A. Whitten, U. S. Coast & Geodetic Survey, Washington 25, D. C.

Surveying and Mapping Literature

MAGAZINE ARTICLES

General Interest

POLAR ROUTE NAVIGATION. Einar S. Pedersen. *Navigation.* (Journal of the Institute of Navigation), Vol. 6, No. 2, Summer 1958. (Discusses problems of navigation over the North Pole by Scandinavian Airlines System aircraft and use of Polar Path gyro.)

SIMPLE SURVEY CALCULATIONS BY CALCULATING MACHINE. Michael Perks. *The Canadian Surveyor,* Vol. 14, No. 3, July 1958. (Mathematical discussion of method.)

THE ORIGIN OF THE DEGREE AND THE HOUR. L. P. Lee. *The New Zealand Draughtsman,* Vol. 1, No. 2, July 1958. (Challenges Greek origin of the degree and supports later idea of origin in the sexagesimal notation fundamental to Sumerian mathematics.)

THE LAW RELATING TO TOWN SUBDIVISIONS (PART I). St. J. Coventry. *The New Zealand Draughtsman,* Vol. 1, No. 2, July 1958. (Outlines history of law controlling land subdivisions in New Zealand towns prior to attaining status of municipalities.)

PITFALLS IN SUPERVISION OF ENGINEERING CONTRACTS. L. D. Nola. *The New Zealand Surveyor,* Vol. 22, No. 4, August 1958. (Notes on an impromptu conference on the subject held at a meeting of the Auckland Branch, New Zealand Institute of Surveyors.)

THE NEW ZEALAND GEOLOGICAL SURVEY ANTARCTIC EXPEDITION, 1957–1958. E. B. Fitzgerald. *The New Zealand Surveyor,* Vol. 22, No. 4, August 1958. (General report on the operation.)

CONGRESSIONAL REGULATION OF ENGINEERING. James R. Wilcox. *Civil Engineering,* Vol. 28, No. 9, September 1958. (Analysis of possible trends in legislation based on court decisions in matters pertaining to engineering.)

THE GALLATIN PLAN AFTER ONE HUNDRED AND FIFTY YEARS. Carter Goodrich. *Proceedings of the American Philosophical Society,* Vol. 102, No. 5, October 20, 1958. (Comparison of the original proposals, put forth in 1808, for the opening of new avenues of north-south and east-west communication by government initiative with the actual construction of roads, canals, and railroads by private, federal, or mixed agencies.)

SOME FACTORS GOVERNING THE DEVELOPMENT OF THE EARTH'S CRUST. V. V. Beloussov. *Endeavour,* Vol. 17, No. 68, October 1958. (Discusses recent research on the subject conducted in Soviet Russia.)

SATELLITE TRACKING: ITS METHOD AND PURPOSE. E. G. C. Burt. *Endeavour,* Vol. 17, No. 68, October 1958. (Describes methods used and results obtained in obtaining data on outer space and valuable information about the Earth.)

THE 11TH GENERAL ASSEMBLY OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS. J. de Graaff-Hunter. *Empire Survey Review,* Vol. 14, No. 110, October 1958. (Report on meeting held at Toronto in September 1957.)

NON-MILITARY USES OF NUCLEAR EXPLOSIVES. Gerald W. Johnson and Harold Brown. *Scientific American,* Vol. 199, No. 6, December 1958. (Suggested applications of nuclear explosive force in various fields such as power production, mining, etc.)

WHAT IS ENGINEERING?—WHO IS AN ENGINEER? John C. Calhoun, Jr. *Journal, Florida Engineering Society,* Vol. 12, No. 4, December 1958. (Reprinted by permission from the January 1958 issue of the *Oklahoma Professional Engineer.* A general analysis.)

Cartography

ELECTORAL BOUNDARIES. C. H. Couch. *The New Zealand Draughtsman,* Vol. 1, No. 2, July 1958. (Discussion of problems and methods used in preparing maps to show boundaries of electoral districts.)

TELECOMMUNICATIONS AND DRAUGHTING. R. J. Finn. *The New Zealand Draughtsman,* Vol. 1, No. 2, July 1958. (Stresses importance of various kinds of maps and drawings in the operation of communications systems.)

ADVANCES IN CARTOGRAPHY IN NEW ZEALAND SINCE 1939. A. W. Hampton. *The New Zealand Draughtsman,* Vol. 1, No. 2, July 1958. (Indicates recent adoption of highly modern methods.)

SOME DEVELOPMENTS IN FRENCH CARTOGRAPHY. Janusz J. Klawe. *The Canadian Surveyor,* Vol. 14, No. 3, July 1958. (General discussion by the Chief Cartographer, Thomas Nelson & Sons Ltd., Edinburgh.)

PHOTOGRAMMETRY—A FEW QUESTIONS ANSWERED. Ray A. Kelsey. *Civil Engineering*, Vol. 28, No. 9, September 1958. (Simplified discussion of topographic mapping from aerial photographs.)

THE PLASTIC FIRMAMENT. (No author given.) *Bakelite Review* (30 East 42nd Street, New York 17, N. Y.) October 1958. (Describes construction of a 6 ft. 3 in. diameter globe using an epoxy resin reinforced with layers of glass fiber to show relief and developed by Geo-Physical Maps, Inc., with collaboration of American Geographical Society.)

LEWIS MORRIS—AN EARLY WELSH HYDROGRAPHER. A. H. W. Robinson. (*The Journal of the Institute of Navigation*), Vol. 11, No. 4, October 1958. (Gives an account of the work of a pioneer in the field and includes description of methods and instruments used in both land and water surveys.)

GOSHUÁ TO PUT ITS NAME ON MAPS. H. H. Slawson. *Modern Lithography*, Vol. 26, No. 11, November 1958. (Information on the H. M. Goshuá Company and the forthcoming new revised edition of the *Goshuá American Highway Atlas.*)

CHEMISTRY OF PAPER WITH SPECIAL APPLICATION IN REPRODUCTION. Hugo H. Hanson. *The International Blue Printer*, Vol. 31, No. 10, October 1958. (Discussion of the fundamentally chemical process of paper making in nonchemical, nontechnical language.)

Control Surveys

TACTICS OF PROGRESSIVE GEODESY. Dr. J. de Graaff-Hunter. *Bulletin Geodesique* (Journal of the International Association of Geodesy) Nouvelle Serie, Annee 1958, Nos. 47/48, March, June, 1958. (Presidential address at 11th General Assembly of the Association, Toronto, September 1957.)

SHORAN TRILATERATION IN THE ARCTIC ISLANDS. W/C J. G. Showler and Angus C. Hamilton. *The Canadian Surveyor*, Vol. 14, No. 3, July 1958. (Consists of paper by Wing Commander Showler on transportation and operational problems and a discussion of technical problems and analysis of results by Mr. Hamilton.)

SPUTNIK AS A TOOL FOR SECURING GEODETIC INFORMATION. Louis Gold. *Journal of the Franklin Institute*, Vol. 266, No. 2, August 1958. (Mathematical discussion to describe how Sputnik tracking data including perigee and apogee, period and orbital velocity may be used to deduce geodetic facts such as mass and mean radius of the Earth without any knowledge of the launching conditions.)

MEASURING DISTANCES AT 669,600,000 MILES AN HOUR. William H. Teller. *Our Public Lands*, Vol. 8, No. 2, October 1958. (Discussion of electronic distance measuring system now employed by Bureau of Land Management.)

NOTES ON THE ANALYTICAL SOLUTION OF THE TWO-POINT PROBLEM. Leung Kui-Wei. *Empire Survey Review*, Vol. 14, No. 110, October 1958. (Mathematical demonstration of two methods of solution.)

A METHOD OF DETERMINATION OF ASTRONOMICAL LATITUDE AND LONGITUDE WHEN ONLY TIME AND HORIZONTAL ANGLES ARE OBSERVED J. C. Bhattacharjee. *Empire Survey Review*, Vol. 14, No. 10, October 1958. (Extended explanation of method with useful examples.)

TRIANGULATION BY THE DIRECTION METHOD. A. P. Atkinson. *Empire Survey Review*, Vol. 14, No. 110, October 1958. (Explanation of a method based on computation by bearings or directions and not by angles.)

ANEROID HEIGHTS: A CORRECTION FOR THE EXPONENTIAL LAPSE RATE. Colonel D. R. Crone. *Empire Survey Review*, Vol. 14, No. 110, October 1958. (Mathematical explanation of the method of correction with a practical application as an example.)

DISTORTION IN CONTINENTAL TRIANGULATION. Charles A. Whitten. *Transactions, American Geophysical Union*, Vol. 39, No. 5, October 1958. (Discusses methods for correcting minor distortions in arcs of triangulation which tend to accumulate with addition of area schemes.)

GEODETIC CONTROL IN JUNGLE AREAS. Carl I. Aslakson. *Transactions, American Geophysical Union*, Vol. 39, No. 5, October 1958. (Describes use of shoran trilateration and shoran controlled photography for geodetic control in a jungle area of northern Guatemala.)

Education

UNIVERSITY TRAINING OF SURVEYORS. A. H. Bogle. *The New Zealand Surveyor*, Vol. 22, No. 4, August 1958. (Report of progress in program to set up university diploma courses in surveying in New Zealand universities.)

Instruments

A REPORT ON THE ORTHOPHOTOSCOPE. Russel K. Bean, U. S. Geological Survey. *The Canadian Surveyor*, Vol. 14, No. 3, July 1958. (Discusses principle of the instrument, and operational experience.)

GODFREY'S INVENTION OF THE REFLECTING QUADRANT. Thomas Coulson. *Journal of the Franklin Institute*, Vol. 266, No. 5, November 1958. (Historical account of the claim of an American inventor to precedence in inventing the device for which Hadley, an Englishman interested in astronomy, has usually received credit.)

Property Surveys

LANDMARKS. C. W. Lester and C. W. Young. *The Canadian Surveyor,* Vol. 14, No. 3, July 1958. (General discussion of the problem of preservation of survey monuments.)

RECENT TRENDS IN SHOPPING CENTER DESIGN WITH PARTICULAR REFERENCE TO THE PORIRUA BASIN. O. J. McCabe. *The New Zealand Surveyor,* Vol. 22, No. 4, August 1958. (Paper presented at meeting of Wellinton Branch, N. Z. Institute of Surveyors.)

JOINT ADVISORY COMMITTEE ON TOWN AND COUNTRY PLANNING. R. P. Gough. *The New Zealand Surveyor,* Vol. 22, No. 4, August 1958. Publishes constitution of newly organized committee.)

TRAVERSE CLOSURE AS A MATHEMATICAL METHOD. John F. Tanner. *Civil Engineering,* Vol. 28, No. 11, November 1958. (Application of method to engineering as well as land surveying problems.)

Topography

11 MILES OF INTERSTATE DESIGNED IN 16 WEEKS. (Author not named.) *Engineering News-Record,* Vol. 161, No. 13, September 25, 1958. (Combination of photogrammetry and electronic computer methods in fast highway design technique.)

BOOKS AND PAMPHLETS

EVALUATING AND MAPPING MOUNTAIN LAND FEATURES FOR FOREST MANAGEMENT PURPOSES. Warren A. Starr and Robert F. Tarrant. Washington, State, Agricultural Experiment Stations, Circular No. 271, Pullman, 1955. 22 pp., illus.

SARAWAK, LAND AND SURVEY DEPARTMENT, ANNUAL REPORT, 1957. Kuching, Government Printer, 1958. 87 pp., maps.

SURVEY OF KENYA, ADMINISTRATION REPORT 1957. Government Printer, Nairobi, 1958. 20 pp., maps.

PROBLEMS IN MAPPING SNOW COVER. Edward B. Espenshade and S. Valter Schytt. U. S. Department of the Army, Corps of Engineers, Wilmett, Illinois, 1956. 92 pp., maps. (Research Report 27.)

NEW JERSEY, SUPPLEMENTAL ROSTER OF LICENSED PROFESSIONAL ENGINEERS AND LAND SURVEYORS, OCT. 1957. Board of Professional Engineers and Land Surveyors, Newark, 1957. 23 pp.

PUBLISHED MAPS OF MONTANA, AN ANNOTATED BIBLIOGRAPHY. Vincent K. Shaudys. Regional Study No. 9, Bureau of Business and Economic Research, Montana State University, Missoula, June 1958. 55 pp., processed.

REVISTA CARTOGRAFICA, ANO 6, No. 6. Instituto Panamericano de Geografia e Historia, Comision de Cartografia. Buenos Aires, 1957. 288 pp., illus., tables, maps, diagrams. (Some articles in English.)

NEW ZEALAND, REPORT ON SURVEYS FOR THE YEAR ENDED 31 MARCH 1958. New Zealand, Department of Lands and Survey, Wellington, 1958. 32 pp.

IDAHO, BOARD OF ENGINEERING EXAMINERS, YEARBOOK 1957. Boise, 1957, 52 pp. (By-laws and rules of procedure, registration law pertaining to professional engineers and land surveyors, annual report of Board of Engineering Examiners, roster of professional engineers and land surveyors, and other information.)

NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL, DIVISION OF EARTH SCIENCES, ANNUAL REPORT, 1956–57. 2101 Constitution Avenue, Washington, D. C., September 1957. Processed. 80 pp.

SOUTHERN RHODESIA—REPORT OF THE SURVEYOR-GENERAL FOR THE YEAR ENDED 31ST DECEMBER 1957. Government Printer, Salisbury, 1958. 3 pp., index map.

BRITISH COLUMBIA—ANNUAL REPORT OF THE LANDS SERVICE, YEAR ENDED DECEMBER 31, 1957. Province of British Columbia, Department of Lands and Forests, Victoria, 1958. 100 pp., illus., tables, diagrams, index maps.

ALABAMA, ROSTER, REGISTERED ENGINEERS AND LAND SURVEYORS, 1958. Board of Registration for Professional Engineers and Land Surveyors, Montgomery, 1958. 86 pp.

KENTUCKY, BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS, 20TH ANNUAL YEARBOOK. Lexington, 1958. 88 pp. (Copy of registration law, by-laws, rules and regulations of the Board, and roster of registered professional engineers for the year ending June 30, 1958.)

THE ANNUAL BULLETIN OF THE BEACH EROSION BOARD, VOLUME 12. Office, Chief of Engineers. Department of the Army, Corps of Engineers, Washington 25, D. C. July 1958. 115 pp.

ROSTER OF REGISTERED PROFESSIONAL ENGINEERS OF THE STATE OF TEXAS, JULY 1958. Board of Registration for Professional Engineers, Austin, 1958. 221 pp.

ECONOMIC GEOLOGY OF THE DARWIN QUADRANGLE, INYO COUNTY, CALIFORNIA. State of California, Department of Natural Resources, Division of Mines, Special Report No. 51. San Francisco, October 1958. 73 pp., illus., maps.

AVAILABLE PUBLICATIONS, CALIFORNIA DIVISION OF MINES. State of California, Department of Natural Resources, Division of Mines. California State Printing Office, November 1958.

CIVIL ENGINEERING HANDBOOK. (Fourth edition.) Porter, Urquhart, McCreary, and O'Brien. *McGraw-Hill*, New York. 1174 pp., 814 illus., 1959. $17.50.

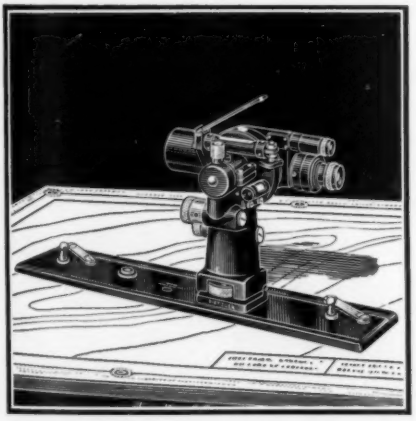
—LYMAN D. LYNN
Coast and Geodetic Survey

Election Results

As a result of the recent balloting, the election of the following officers and directors, to serve the American Congress on Surveying and Mapping, is announced:

President—George C. Bestor
Vice President—H. Arnold Karo
Directors (1959–60)
C. J. Aggeler
William C. Cude
John A. Law
Clifford A. Thorpe, Jr.
James P. Webb

The above officers will assume their duties at the close of the 19th Annual Meeting in March 1959 and continue through the 20th Annual Meeting. The directors, having been elected for two-year terms, will, of course, continue in office through the 21st Annual Meeting.



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Distinctive Recent Maps

World wide distribution and jurisdictions of the *Churches of the Anglican Communion* are presented on a map copyrighted in 1957 by George Philip & Son, Ltd., of London. It was published for the Church Assembly Overseas Council by the Church Information Board, Church House, Westminster, S.W. 1, England. Copies of the map, at 4/ each (postage extra) may be ordered through the latter organization. The map, which is in color, measures 22 by 36 inches. A smaller (14 by 23 inches), uncolored edition of the map is available, at 9d. each, from The Girls' Friendly Society, Townsend House, Greycoat Place, London, S.W. 1, England.

The Commonwealth of Nations is a colorful map which identifies the independent countries, colonies, protectorates, protected states, and mandated and trust territories which comprise the British family of nations. It was published, in 1958, by Her Majesty's Stationery Office, London. The forms of government for each category are indicated by distinctive color patterns. The map measures 29 by 40 inches.

General Drafting Company, Inc., longtime producer of road maps for Standard Oil Company affiliates, has in recent years engaged in the preparation of motoring maps of foreign countries. Included in a recent group of General Drafting accessions are maps and pictorial guides of *Western Europe and Adjacent North Africa, Aruba, Canada's Mountain Playgrounds, and Central Ontario Holiday Map and Cruising Guide*. All are similar in format, and feature the same symbols and cartographic techniques which are familiar to users of ESSO's popular series of State and regional maps.

Map of Western Canada Showing the Protein Content of Hard Red Spring Wheat 1958 Fnal Map, is a publication of the Grain Research Laboratory, Board of Grain Commissioners, Winnipeg. The map, which measures 11 by 21 inches, outlines wheat areas with protein contents of under 11%, 11 to 12.9%, 13 to 14.9%, and over 15%.

The Hudson's Bay Company is one of the historical and economic institutions of Canada. Incorporated in 1670, the HBC has played an important role in the Dominion's history and development. Of special interest, therefore, is a 1957 map of *Canada Showing the Establishments of the Hudson's Bay Company*. It was published by the Fur Trade Department, Winnipeg, Canada, on a base map of Canada's Department of Mines and Technical Surveys. The scale is 1:6,336,000 and the dimensions are 24 by 34 inches.

Forest Classification of Canada 1957, delimits ten forest regions in addition to grassland and tundra areas. It is at the scale of 100 miles to an inch and measures 24 by 37½ inches. The map was compiled and drawn by the Forestry Branch, Department of Northern Affairs and National Resources, Ottawa, Canada. The price, listed on the map, is $.50.

Paths of West Indian Hurricanes for 11 Years, 1947–1957 Inclusive is a 1958 publication of Cravens, Dargan & Company, Insurance Managers, of Houston, Texas. The map, compiled from data furnished by the U.S. Weather Bureau, shows by green lines "hurricanes not touching Texas or Louisiana coast line," and by red lines "hurricanes touching Texas or Louisiana coast line." The map sheet is 18½ by 32 inches, and the scale is approximately 1:11,000,000.

Another *Hurricane and Storm Track Map, Gulf of Mexico* has been compiled and published (in May 1958) by E. P. Chatelain and J. Geracci of New Orleans, Louisiana. Cartography is by J. L. Stansbury. The scale is 1:3,000,000 and the size 24 by 33 inches. Data is from the U.S. Weather Bureau. Marginal insets include a track map of the great hurricane of 1926, a bar graph showing "Number of Tropical Storms Reaching U.S. Coast in Five Year Periods," a table listing "Hurricanes Entering U.S. Mainland 1887–1957," and a list of "Terms frequently used in hurricane advisories."

"The water balance of a given land area, land region, or surface water body of the earth most simply stated is an input-output calculation of moisture receipts, retention, and loss . . . over a given period of time." The water balance of eastern North America is presented on three maps prepared by C. W. Thornthwaite, John R. Mather, and Douglas B. Carter. All three are at the scale of 1:5,000,000. They present, respectively, *Water Surplus, Potential Evapotranspiration*, and *Water Deficit* based on mean annual figures. The maps, and an explanatory booklet, were published by Resources for the Future, Inc., in November 1958. Edward A. Ackerman, formerly on the staff of that organization, prepared the foreword of the booklet.

The *State of North Carolina* is a recent addition to the U.S. Geological Survey's series of attractive shaded-relief maps. It is at the scale of 1:500,000 and measures 26 by 64 inches.

Copies may be ordered from the Washington, D.C. office of the Survey.

Historic Massachusetts, A Travel Map was prepared "to help you feel at home in the Bay State." It was designed and drawn by Ernest Dudley Chase, well-known cartographic artist, and published in 1957 by the Massachusetts Department of Commerce, 334 Boylston Street, Boston 16, Massachusetts. The face of the map is decorated with colorful and attractive sketches of historic relics, scenic and tourist attractions, significant landmarks, and other centers of interest. The map sheet is 21 by 34 inches. There is an inset of "Greater Boston."

The seventh edition of the *Zoning Use Map of Washington, D.C.* was published in 1958 by Rufus S. Lusk & Son, Inc., 1824 Jefferson Place, Washington 6, D. C. It measures 51 by 68 inches and is at the scale of 800 feet to an inch. Twenty use areas are outlined under the major categories of Residence, Special Purpose, Commercial, and Industrial. A table summarizes "Use Regulations."

The John Carter Brown Library, Providence, Rhode Island, is one of the significant repositories for rare Americana. Among its treasures are a number of historical printed and manuscript maps. In recent years the trustees have made available, in facsimile reproductions, choice cartographic items from the Library's collections.

Issued in 1958 was a decorative and handsome collotype reproduction of *A Mapp of New Jersey in America*, by John Seller and William Fisher, London, 1677. The facsimile is representative of the excellence and artistic skill of the Meriden Gravure Company of Meriden, Connecticut, who prepared the collotype. The map, which measures 23 by 26 inches, includes a perspective view of New York City and harbor, and a lengthy essay entitled "The Description of the Province of West Jersey in America."

The facsimile is accompanied by a four-page descriptive leaflet. In it we note that the "*Mapp of New Jersey* was designed to attract potential settlers and investors . . . [and] is part of a large body of promotion literature about East and West Jersey published between 1676 and 1685, in which the [John Carter Brown] Library is particularly rich."

Deposits of more than 80 minerals are located on the *Mapa Minero de la Republica Argentina* published in 1957 by Dirección Nacional de Mineria, Argentine Ministerio de Comercio e Industria. It is at the scale of 1:4,500,000 and measures 35 by 18½ inches.

Mapa de la Republica del Ecuador was copyrighted in 1958 by Aguilar of Madrid. At the scale of 1:1,000,000 it shows the generalized relief and administrative divisions of Ecuador. The map sheet, which measures 35 by 49 inches, includes an inset map of Galapagos Islands and eight small maps of Ecuador featuring various physical and economic aspects of the country.

Two informative new maps featuring petroleum distribution were published in 1958 by Union des Chambres Syndicales de l'Industrie du Pétrole, 16, Avenue Kleber, Paris, 16, France. The first, entitled *L'Industrie Française du Pétrole,* shows petroleum and natural gas deposits, pipelines, refineries, and maritime movement of petroleum into France. Oil producing regions of overseas France are shown on marginal maps. Several production graphs also occupy the map sheet.

Le Pétrole dans le Monde maps the worldwide distribution of petroleum fields, refining centers, and the global movements of oil. There are enlarged insets of the Middle East, the United States, and Venezuela.

Italia is the title of a two-sheet hypsometric relief map of Italy published in 1957 by Istituto Geografico Militare, Firenze. Each sheet is approximately 34 by 44 inches and the scale is 1:1,000,000. In addition to relief, such customary cultural features as roads, railroads, towns, cities, and administrative boundaries are shown.

The politically-disturbed eastern Mediterranean area is the subject of Freytag-Berndt's (Vienna, Austria) road map *Kleinasien und Östliches Mittelmeer*. The title and legend are also given in English, French, Turkish, and Arabic. The map includes Greece, Turkey, the north coast of Africa eastward of Tripoli, and Syria, Lebanon, Israel, Jordan, and portions of Iraq and Saudi Arabia. The scale is 1:2,000,000 and the size 34 by 44 inches.

Two new maps of Lebanon provide recent data of interest for that strategically located Middle East country. *Carte Routiere du Liban* is a 1957 revision of a map, compiled by Joseph H. Chéhab and published by Joseph S. Saikau, Beyrouth. It is at a scale of 1:200,000 and measures 38 by 26 inches. There is an enlarged inset (1:100,000) of Beyrouth and environs. A variety of cultural features are shown, in addition to four classes of roads. Distances, in kilometres, are given between road intersections and inhabited places.

Carte de Reconnaissance des Sols du Liban delimits more than thirty different soil types. It was prepared under the direction of Bernard Gèze for the Lebanon Ministry of Agriculture. It measures 37 by 27½ inches and is at the scale of 1:200,000.

The geology of the U.S.S.R. is shown on a small scale (1:7,500,000) two-sheet map published in 1937 by Vessoiuznyu Geologicheskii Institut, Leningrad. It was prepared under the editorial direction of D. V. Nalivkin. Each sheet measures 30 by 26 inches.

A particularly noteworthy recent accession is a *Vegetation Map of Central Asia* (Karta Rastitel'nost Srednei Azee), published in 1956–57 by

Akademia Nauk, Moscow. It was compiled in the Academy's B. L. Komorov Botonic Institute and is based on data gathered by the Institute's Aral-Caspian Expedition. The map was prepared under the general direction of E. M. Lavrenko, with L. E. Rodin as Editor and A. A. Gerbikh as Technical Editor. It is at the scale of 1:1,000,000 and includes 17 map sheets and a legend. A small index map is printed in the lower margin of each sheet.

A three-sheet *General Map of Soil Types in Japan,* was compiled by Yutaka Yamoshita. The map was published in 1957, by the National Institute of Agricultural Sciences, and was printed by Naigai Chizu Co., Ltd., 1–4 Kandanishikicho, Chiyoda-Ku, Tokyo. The individual sheets measure 36 by 27½ inches and the scale is 1:800,000. Fourteen different soil types are shown, in addition to "mountain soil."

Carte des Voies de Communications du Moyen-Congo-Gabon is an up-to-date presentation of the communications network of the Congo Basin and adjoining regions. It was designed and published by Service Geographique of French Equatorial Africa, Cameroun. The scale is 1:1,500,000 and the dimensions are 27 by 34 inches.

Except for small sketch maps published in newsmagazines and daily journals, cartographic representation usually lags some months behind official changes in political administration and geography. Thus, only recently has there been published, by the Survey Department of that recently established republic, a new map of *Ghana.* It measures 20 by 14 inches and is at the scale of 1:1,500,000. District, regional, and international boundaries, roads (existing and under construction), and railways are shown.

The portion of *Cameroons Under United Kingdom Administration* extends, with a slight break, between Lake Chad and the Gulf of Guinea. It was published in 1958 by the Federal Survey Department, Nigeria. Administrative subdivisions, railroads, roads, telegraph lines, and other cultural features are shown. The scale is 1:1,750,000 and the size is 26 by 17 inches.

The U.S. Hydrographic Office has issued a revised edition [1957] of its chart number 2562-D entitled *Antarctica Surface and Airline Distances.* It is available, at $1.20 per copy, from U.S. Navy Hydrographic Office, Washington 25, D. C. The chart measures 31 by 50 and is at the scale of 1:11,250,000. The airline-distance data are superimposed on the chart showing soundings and submarine contours.

The Directorate of Overseas Surveys [Great Britain] published, in 1958, a detailed topographic map of *South Georgia,* in the Falkland Islands Dependencies. The surface configuration and elevation of land and glaciers are shown by means of contours. The map, which measures 24 by 35 inches, may be ordered from Edward Stanford Ltd., 12–14 Long Acre, London, W.C. 2, England. The price is listed as 4/ net.

WALTER W. RISTOW
Library of Congress

Work-Study Training Program

The United States Civil Service Commission has announced a Work-Study Training Program for high school seniors, high school graduates, and college students for work-study participation in Federal agencies in the following fields: Architecture, Chemistry, Mathematics, Metallurgy, Meteorology, Oceanography, and Physics. Student Trainees earn—(GS-2) $3,255; (GS-3) $3,495; (GS-4) $3,755—per year. Written tests are required. Applications filed prior to completion of courses or by those otherwise qualified will be acepted not later than April 2, 1959. Many other training programs are open to college students, including CARTOGRAPHY which is at the GS-4 ($3,755) requirement only. Consult your school placement office for information on Form 5000-AB and U. S. Civil Service Commission "Student Trainee" announcement No. 172, or write to the U. S. Civil Service Commission, Washington 25, D. C., or your nearest Civil Service district office. Work-study programs have been set up in the U. S. Departments of Agriculture, Air Force, Commerce, Navy, and the Potomac River Naval Command.

The Surveyor and the Law

More on Proportionate Measurement

One of the longest trials involving land boundaries has finally appeared in print (Nov. 28, 1958, Advanced California Appellate Reports, Bancroft Whitney Company, page 54). After about 340 days, and about 38,000 typed pages later, a verdict was reached. William Wattles (a former vice president of ACSM) was cross-examined for some 46 days. An official copy of the transcript cost some $6,000.

Of course, the land was valuable. Oil was discovered. Chandler (*Chandler et al* v. *Hibberd et al*) was the owner of the south half of Section 25 (leased to the Superior Oil Company). Section 36, lying immediately south of Section 25, was owned by Hibberd and leased to the Richfield Oil Company. The dispute arose over the location of the common line between Sections 25 and 36, Township 10 North, Range 27 West, San Bernardino Meridian.

To avoid using such words as plaintiff, defendant, appellants, respondents, etc., in this summary the word "Superior" will be used to include all owners and interested parties in Section 25 and "Richfield" will be used to include all parties interested in Section 36.

Superior claimed that the line between Sections 25 and 36 had to be located by proportionate measurements. Richfield claimed that the line was fixed by an old fence (acquiescences, agreement or adverse possession). The original section corners were either lost or obliterated. It was stipulated that the court was to determine the true location of the common line between Sections 25 and 36 whether the fence constituted the original ownership line or not.

The lower court declared that the fence *did* constitute the true ownership line and declared that the true original section line was north (at a specified place) of the fence line. The court rejected proportionate measurement in this case. Upon appeal to a higher court (Appellate), the higher court declared that the fence line *did not* constitute an agreed property line and that the true section line, as determined by the lower court, must be used. Since this section line was north of the fence, Richfield obtained more land than they contended to be theirs.

Two items are of interest to surveyors. (1) Why was proportionate measurement rejected? (2) What was it that determined the section line when the original corners were absent from view? As of secondary interest, why did the lower court accept a fence and the upper court reject it?

The fence erected between the two properties was the result of a survey, was for the purpose of a cattle enclosure, and was erected by a leasee. The owner of Section 25, at the time of the erection of the fence, wrote a letter (1938) to the owner of Section 36 to the effect that he would not object to the erection of the fence "as long as he did not make a boundary line between the two properties." For this reason the upper court reasoned that the fence was not an agreed boundary nor was it acquiesced in. Since the upper court did not accept the fence, the original location of the section line between Sections 25 and 36 became the division line.

Proportional Measurement. Superior contended that the corners common to Sections 25 and 36 were lost and that proportionate measurement was the only means that could be used to restore them. Their contention was that the court must accept measurements between a corner a mile north of the disputed line and a corner a mile south of the disputed line and then reset the "lost" corner by proportionate methods. When doing this a 660-foot shortage existed; hence, Sections 36 and 25 would each be 330 feet short. Of course, this contention is perfectly valid providing (1) the missing corner is in fact lost and (2) providing the corners from which the measurements are made are in fact the original corners.

An examination of the evidence presented indicates that the corners one mile north of the disputed corners were questionable. The surveyor for Superior accepted an old fence line as being the north line of Section 25. The authenticity of the original corners along this line was never proven. To further complicate

things, the corners located more than a mile to the north of the disputed line fell within the limits of Cuyama Rancho and were never set. "The court found that they (corners along the north line of Section 25) were not actually relocations of corners or corner accessories of the original (Glover) survey and that they are not located in the position of Glover's corners or accessories." There being no north line established for Section 25, the shortage in boundaries disappears and with it the sole basis for relocation of the corners of the south line of Section 25 by proportionate means.

Upon commenting on the proportionate method, the following points were brought out. Proportionate measurement "must not be resorted to unless all other prescribed methods fail" (*Verdi Development Co.* v. *Dono-Han Mining Co.,* 296 P2nd 429). Proportionate measurement is not used "if the line can be retraced as it was established in the field" (*County of Yolo* v. *Nolan,* 77 P 1006). "If the exact spot (for a corner) cannot be found, it (the court) must, if possible, decide from the data appearing in evidence its (the corner) approximate position, and the proportionate method is to be used only when no other reasonable method is possible and it must be so used that it does not contradict or conflict with the official data that are not impeached, and which, when not impeached, confine the actual position within certain limits." (*Weaver* v. *Howatt,* 161 Cal 77). "The law is well established that the obliteration of a monument made in a survey does not destroy such survey nor justify a court in disregarding it where enough data remain to locate the place occupied by the monument by reference to natural objects referred to in the survey. Nor does such obliteration justify the adoption of the proportionate method of locating a common corner as a lost corner, where the field-notes refer to certain natural objects which can be found along the line mentioned so as to approximately locate it." (*Hammond Lumber Co.* v. *Haw,* 274 P 386).

The court found that the corners were obliterated, not lost. In deciding where to locate the obliterated corner, the court examined (by field trips) the topography and other evidence to be found in the field and compared the topography and evidence with the original field notes. J. R. Glover, a United States Deputy Surveyor, made the original controlling survey in 1881 and 1883. The terrain was rough. The marks set by Glover to monument the corners of Section 25 were not found.

The southwest and southeast corners of Section 36 were found and were not in dispute. The rerunning of the westerly line of this section illustrates the court's processes of relocating the obliterated corners. The call of Glover's notes is "Ascend. 31.00 (chains) Top of spur, bears East and West, descend." The court found this spur at a distance of 31.26 chains with certainty. The next note states, "67.57 Cross gulch 10 links wide, course Northwest and ascend." The gulch was found identifiable with certainty, but it was found to be 73.20 chains north of the southwest corner instead of 67.57 chains. The next call was "70.00 Top of spur, bears Northwest and Southeast and descend. 80.00 set post for corner." There was an ascent to the spur and a descent to the corner. If proportionate measurements were used, the proportionate point would fall on the ascent to the spur instead of on the descent from it. The court found that the most certain location for the section corner was 12.43 chains north of the gulch and on the descent as called for in the field notes. This made the section line 85.63 chains long. Superior had contended there was a shortage of five chains; the court concluded that there was an overage of 5.63 chains.

The east boundary of Section 36 did not have many natural monuments. The east boundary, being a township line, was retraced twice by early deputy surveyors and found by them to be as originally reported (or very nearly so). Certain "descents" and "enter rolling land" were identified closely in accordance with the original notes. Since the terrain was consistent with the notes, the court ruled that the proper location of the corner was 80.12 chains (at N. 0° 06′ 20″ W.) from the southeast corner of Section 36 as called for in the original notes. The bearing was arrived at by means not clear in the report.

The following points, as quoted from previous court cases, were brought out. "It is not the province of the court to determine where the corner should have been fixed. This is not an action to vacate the government survey. It must be assumed that the line was measured and the monuments set. Their positions, as set, fix the rights of the parties, regardless of the inaccuracy of the measurements and the errors in distance found in the field-notes. The trial court must ascertain, as near as may be, where this monument was set by the government surveyor" (*Weaver* v. *Howatt,* 161 Cal. 77). On page 86 of this same case is stated, "It is for the trial court, upon all the evidence, to fix the place at a point where it will best accord with the

natural objects described in the field-notes as being about it, and found to exist on the ground, and which is least inconsistent with the distances mentioned in the notes and plat." And in 171 Cal 302 is, "The court is bound to assume that the line was run on the ground and that the post was set in a mound of stones at a place fixed for the common corner of the four sections as the field-notes show. All trace of that monument has disappeared, and the exact place where it was erected cannot now be identified. But under the above rules these circumstances do not destroy the survey nor justify the court in disregarding it, when enough can be ascertained therefrom and identified on the ground to approximately locate the corner. The court, under the above authorities, and in obedience to the former decision of this court, could not do otherwise than it did, that is, fix the corner 'at a point where it will best agree with the natural objects described in the field-notes as being about it, and found to exist on the ground and which is least inconsistent with the distances mentioned in the notes and plat.' The government owned the land, caused the survey to be made, and sold the land by reference thereto. Purchasers must abide by the result regardless of the lack of rectangular shape of the subdivisions so made."

Comments on the Case. In this case proportionate measurement was rejected for the obvious reason that the original location of corners from which proportionate measurement could have been made were never proven. If the location of the corners north of the obliterated corners could have been identified beyond a shadow of doubt, would the outcome have been the same? I am inclined to think that it would.

Proportionate measurement, as clearly brought out, is a "rule of last resort." All other means must be proven unapplicable before resorting to proportionate measurement. "In the absence of senior rights, excess and deficiency found to exist between original monuments are distributed among the lots in proportion to the original record measurement of the lots. This is a principle of last resort" (*Boundary Control and Legal Principles,* by Curtis M. Brown).

When the public lands were surveyed, field notes were kept. The terrain, natural monuments accessories and like objects called for in the original government field notes make it improbable that proportionate measurement will be used to restore corners in sectionalized lands. But in the case of private surveys, such as a local subdivision done by a local surveyor, field notes are usually not available. Without field notes to identify natural objects, the usage of proportionate measurement, as a last resort, is much more frequent. The number of times that proportionate measurement may be used increases with a decrease in knowledge of what the original surveyor did. Proportionate measurement is a means of disposing of errors the location of which cannot be explained, and, with meager original survey notes, many errors cannot be explained.

The method used by the court to locate lost corners by identifiable natural objects is following well established principles. Quoting from *Boundary Control and Legal Principles:* Section 171. "The boundaries of the public lands, when approved and accepted are unchangeable, except by resubdivision." Section 172. "The original township, section, and quarter-section corners must stand as the true corners which they were intended to represent, whether in the place shown by the field-notes or not." Section 177. "The plat and all the original field-notes become a part of the grant." Section 184. "Where the direction of a line can be determined from the mean position of line trees or blaze markers, the direction so established will be controlling where the corner monument is lost. Sometimes a stream or canyon crossing becomes controlling, especially where the crossing is close to a corner."

When making a survey, it is often a temptation for the surveyor to "bury" discrepancies by proportionate means rather than diligently spend the time to discover the cause of the discrepancy. Proportionate measurement should not be used except as a last resort.

—Curtis M. Brown

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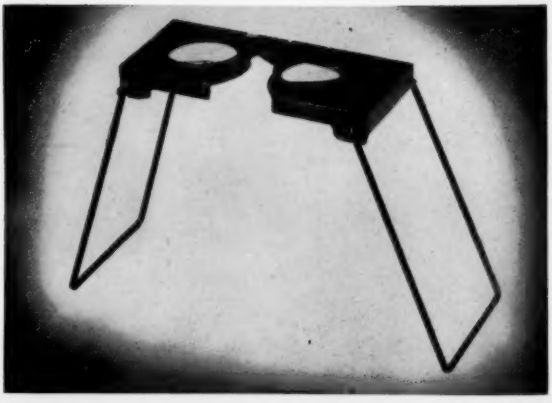

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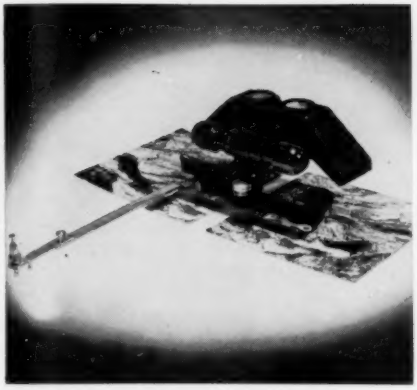

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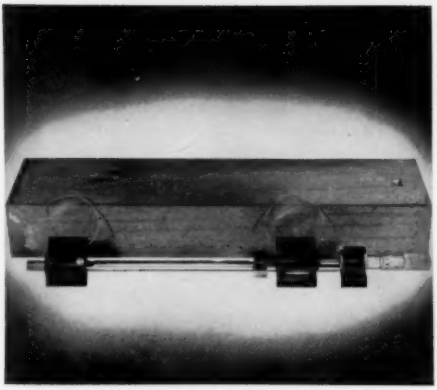

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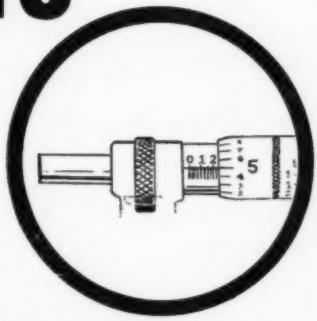

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Books in Review

PROCEEDINGS OF THE FIFTH ARIZONA LAND SURVEYORS' CONFERENCE. A publication of the Engineering Experiment Station, University of Arizona. vi + 54 pp. $1.50.

This paper covered publication, with a page size of 8½ × 11 inches, contains the Proceedings of the Fifth Arizona Land Surveyors' Conference presented at the University of Arizona March 29, 1958. The Conference was sponsored by the Civil Engineering Department of the University of Arizona.

The papers published are as follows:

The Professional Land Surveyor—His Rightful Place in Our Society, by Daniel M. Weir.

Modern Surveying Instruments, by Philip B. Newlin.

Electronic Distance Measuring Instruments, by John Featherston.

Remarks on Land Surveying, by John C. Park.

The Role of the Land Surveyor in City Planning, by John Beatty.

Legal Aspects of Surveying, by Ray Peterson.

Photogrammetry, by Earle V. Miller.

The publication also contains a roster of the 73 engineers or surveyors attending the conference and a roster of the 19 students in attendance. There is also a list of publications which may be ordered from the Mailing and Mimeographing Bureau, University of Arizona, Tucson, Arizona.

HOWARD S. RAPPLEYE

THE EARTH AND ITS GRAVITY FIELD. W. A. Heiskanen, F. A. Vening Meinesz. *McGraw-Hill Book Co., Inc.* New York, 1958. 470 pages.

Every reader of SURVEYING AND MAPPING who is interested in mapping or charting on a national or international scale should have a copy of "The Earth and its Gravity Field." The basic theories relating to gravity and the physics of the earth, the actual techniques for measuring the value of gravity, and the methods for applying such data to large scale mapping projects are only a few of the parts of the text. However, these are the fundamental concepts that are required for a thorough understanding of the geoid and its relationship to an ellipsoid. This relationship must be known for precise surveying and accurate mapping.

The authors are well known in the United States. Dr. W. A. Heiskanen has been the Director, Institute of Geodesy, Photogrammetry, and Cartography, Ohio State University, for several years. He is currently on leave of absence from the Finnish Geodetic Institute. Dr. F. A. Vening Meinesz is also on leave of absence from his European post. He is Professor, Institute of Mineralogy, Geology, and Geophysics, University of Utrecht and this year is lecturing in geology at Michigan State College. Dr. Heiskanen wrote Chapters 4 to 9 and Dr. Vening Meinesz wrote Chapters 1 to 3 and 10 to 12. They were very ably assisted by Dr. J. Allen Hynek of the Smithsonian Astrophysical Observatory who reviewed the manuscript for accurate English idiom.

The first chapter explains the purpose of the book and gives in a brief form the contents of the other eleven chapters. The second chapter may also be considered as introductory, inasmuch as it defines the earth, its crust, its mantle, and its core. This informative treatment of the internal constitution of the earth also serves as a base for various geophysical hypotheses presented in later chapters.

Chapters 3 through 9 deal specifically with gravity. The reader will find a complete description of the gravity field with its mathematical relationship to the spheroidal earth. Means for measuring relative values of gravity over the surface of the earth and techniques for reducing these values to mathematical quantities defining equipotential surfaces are fully discussed. The chapter on physical geodesy opens with a brief history of geodesy and then gives a a practical application of the gravimetric method for controlling or positioning continental networks of triangulation. In Chapter 9 there is an extension of this application to a world wide geodetic system. The last three chapters deal with broader geophysical studies of the crust, emphasizing isostatic equilibrium, stresses and movements, and the resulting shear patterns.

Engineers and scientists engaged in surveying and mapping will find many points of interest

in the chapters on gravity and the use of the gravimetric method for establishing datums for horizontal control. Persons who are interested in vertical control will be disappointed in that the authors did not include a section on the use of gravity for determining dynamic heights. This further application has become increasingly important to large scale engineering projects involving water resources.

In addition to the value of this text as a reference guide, the reader will find the bibliography listed at the end of each chapter very useful. There is also a complete subject index to assist the reader. The authors and publishers are to be commended for the content, style, and timeliness of this volume describing the gravity field of the earth.

CHARLES A. WHITTEN

Seismic Sea Wave Warning Sytem Extended

The addition of the Fiji Islands, Australia, and Chile as cooperating members of the seismic sea wave warning system, which was originally organized for the protection of the Hawaiian Islands against such sea waves, has now expanded the facilities to cover almost the entire Pacific area. The expanded program is the result of requests by those countries to participate in the system.

The warning system was developed by the Coast and Geodetic Survey after a seismic sea wave or "tsunami," which is the Japanese name for it, devastated the Hawaiian Islands in April 1946 with a loss of 170 lives and property damage amounting to $25,000,000.

As the name implies, the warning system is not an instrument or ingenious device, but a highly integrated organization for detecting submarine earthquakes and estimating the time of arrival of damaging sea waves caused by them.

The success of the warning facilities depends almost entirely on rapid communications between the system's center at the Survey's Honolulu Magnetic Observatory, a detecting network of nine seismograph stations and 24 tide stations, and warning centers in the participating countries. This excellent communication service, which, under ideal conditions, may give 15-minute service for a request for information and the reply between Honolulu and Tokyo, is provided by the U. S. Navy, Army, Air Force, Civil Aeronautics Administration, Weather Bureau, and others.

Areas serviced by the present system include the west coast of the United States, Alaska, Hawaiian Islands, Chile, Peru, Japan, the Philippine Islands, Australia, Fiji Islands, and any Pacific Ocean islands where the U. S. Navy or CAA have interests. The system furnishes alert and warning information over the trunk line communications to warning centers located in each area. At these points the local authorities take over with their own warning facilities.

The warning centers for the new areas are located at Valparaiso, Chile; Nauru Island, just north of Australia; and on Nandi Island for the Fiji area. The west coast of the United States came into the system in June 1957 and the center has been located at the Office of Defense and Civilian Mobilization Western Warning Center at Hamilton Field, California. At that time five charts were made, showing the time required for seismic sea waves from various points along the northern rim of the Pacific to reach the west coast.

The warning center in Valparaiso will furnish information on any unusual wave action noted at the tide station located there. The Fiji Island center is unique since it will furnish both earthquake data and information from local tide gages.

Detecting and predicting the time of arrival of a sea wave, which may splash to a height of 125 feet as it breaks against a coastline, presents an unusual problem. Unlike hurricanes —the terror of the Atlantic Coast—sea waves cannot be tracked or detected by planes or ships at sea. Even the occurrence of an earthquake does not mean that a wave is on its way. Only by observation of the wave itself can warning be given.

In the actual operation of the system, the following sequence of events usually takes place after a large earthquake: The Honolulu Headquarters locates the earthquake center from the reports of the seismograph stations, usually within an hour and a half. It requests several of the 24 tide stations, which are manned on a voluntary basis 24 hours a day, to watch their gages for unusual sea wave activity. If the tide stations report a wave having the characteristics

(Continued on page 112.)

Map Information

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between September 1 and November 30, 1958. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, township and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C. (or Denver 15, Colo., for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour of a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama

FLORENCE—Lauderdale
GENEVA*[2]—Geneva
HARTFORD*[2]—Geneva
PRIDE—Colbert
TUSCUMBIA—Colbert

Alaska

Big Delta (A-3)*—Fourth Judicial Division
BLACK (A-1)*—Second Judicial Division
BLACK (A-2)*—Second Judicial Division
BLACK (B-1)*—Second Judicial Division
BLACK (C-1)*—Second Judicial Division
CAPE MENDENHALL (D-2)*—Second Judicial Division
CAPE MENDENHALL (D-3)*—Second Judicial Division
CAPE MENDENHALL (D-4)*—Second Judicial Division
CAPE MENDENHALL (D-6)*—Second Judicial Division
FORT YUKON (C-3)*— Fourth Judicial Division
HEALY (C-6)*—Fourth Judicial Division
KATEEL RIVER (A-6)*—Fourth Judicial Division
KATEEL RIVER (B-6)*—Fourth Judicial Division
KATEEL RIVER (C-4)*—Fourth Judicial Division
KATEEL RIVER (C-5)*—Fourth Judicial Division
KWIGUK (B-2)*—Second Judicial Division
KWIGUK (B-3)*—Second Judicial Division
KWIGUK (C-1)*—Second Judicial Division
KWIGUK (C-2)*—Second Judicial Division
KWIGUK (C-3)*—Second Judicial Division
KWIGUK (D-2)*—Second Judicial Division
McGRATH (D-5)*—Fourth Judicial Division
McGRATH (D-6)*—Fourth Judicial Division

MELOZITNA (A-6)*—Fourth Judicial Division
MT. HAYES (A-2)*—Fourth Judicial Division
MT. HAYES (B-3)*—Fourth Judicial Division
MT. HAYES (B-4)*—Fourth Judicial Division
MT. HAYES (C-2)*—Fourth Judicial Division
MT. McKINLEY (D-2)*—Fourth Judicial Division
NABESNA (C-3)*—Fourth Judicial Division
NABESNA (D-3)*—Fourth Judicial Division
NUNIVAK ISLAND (A-2)*—Second Judicial Division
NUNIVAK ISLAND (A-3)*—Second Judicial Division
NUNIVAK ISLAND (A-4)*—Second Judicial Division
NUNIVAK ISLAND (A-5)*—Second Judicial Division
NUNIVAK ISLAND (A-6)*—Second Judicial Division
NUNIVAK ISLAND (A-7)*—Second Judicial Division
NUNIVAK ISLAND (B-2)*—Second Judicial Division
NUNIVAK ISLAND (B-3)*—Second Judicial Division
NUNIVAK ISLAND (B-4)*—Second Judicial Division
NUNIVAK ISLAND (B-5)*—Second Judicial Division
OPHIR (A-1)*—Fourth Judicial Division
PETERSBURG (D-4)*—First Judicial Division
PORT ALEXANDER (C-2)*—First Judicial Division
PORT ALEXANDER (D-4)*—First Judicial Division
PORT ALEXANDER (D-5)*—First Judicial Division

Arizona

EL MIRAGE—Maricopa
SAN XAVIER MISSION*[1]—Pima
SUNSET PASS*—Coconino
TOLLESON—Maricopa
TUCSON—Pima
WADDELL—Maricopa
WINSLOW*—Navajo

California

BONDS CORNER—Imperial
CADIZ*—San Bernardino
CAMINO*[2]—El Dorado
ESSEX*—San Bernardino
FLYNN*—San Bernardino
HEBER—Imperial
HERNANDEZ VALLEY*—San Benito
LASSEN PEAK*—Shasta
MANTECA*[2]—San Joaquin
MANTON*—Tehama
MANZANITA LAKE*—Shasta
MAXWELL*[2]—Colusa
MONTGOMERY CREEK*—Shasta
ORTIGALITA PEAK*[1]—Merced
PRIEST VALLEY*[1]—Monterey
QUINCY*[2]—Plumas
SAN BENITO*[1]—San Benito
WHITMORE*—Shasta

California-Nevada

TOPAZ LAKE*—Mono
TAHOE*[2]—Placer

Colorado

HYANNIS PEAK—Jackson
LAKE AGNES—Grand

Connecticut

AVON[1]—Hartford
COLLINSVILLE[1]—Hartford
NEW HARTFORD[1]—Litchfield
NORFOLK[1]—Litchfield
WEST TORRINGTON[1]—Litchfield

Connecticut-Massachusetts

TARIFFVILLE[1]—Hartford

Connecticut-New York

SHARON[1]—Litchfield

District of Columbia-Maryland-Virginia

WASHINGTON WEST—District of Columbia

Georgia

ALBANY*—Dougherty
BURTON LAKE—Rabun
HELEN—White
RICO—Fulton
ST. CATHERINE SOUND—Liberty
TIGER—Rabun

Idaho

CAMBRIDGE*—Washington
CRANE CREEK RESERVOIR*—Washington
HORNET*—Adams
INDIAN CREEK RESERVOIR*—Ada
LEADORE*—Lemhi
MOUNTAIN HOME*—Elmore
THORN CREEK SE—Lincoln

Illinois

COLFAX*—McLean

Illinois-Indiana

HUTSONVILLE*—Crawford

Indiana

BEDFORD WEST—Lawrence
BORDEN[1]—Clark
BUCKTOWN[1]—Sullivan
BUTLERVILLE—Jennings
CARLISLE[1]—Sullivan
CENTER POINT—Clay
NORTH VERNON—Jennings
OWENSBURG—Greene
POLAND—Clay
SALINE CITY—Clay
SCOTLAND—Greene
SPEED[1]—Clark
WHITEHALL—Owen
WILLIAMS—Lawrence

Indiana-Kentucky

VEVAY NORTH—Switzerland

Iowa

HONEY CREEK—Pottawatamie
RANDOLPH—Fremont
TABOR—Fremont
TABOR NE—Fremont
TABOR SW—Fremont
TAYLOR—Pottawatamie

Iowa-Nebraska

LOVELAND—Pottawatamie

Kansas

ALIDA[1]—Geary
CEDAR POINT—Chase
FORT RILEY NE[1]—Geary
HYMER—Chase
JUNCTION CITY[1]—Geary
KEATS[1]—Riley
MANHATTAN[1]—Riley
MILFORD[1]—Geary
OGDEN[1]—Riley
PAOLA WEST—Miami
PEABODY—Marion
PEABODY NW—Marion
PLYMOUTH—Lyon
SWEDE CREEK[1]—Geary

Kentucky

PLEASANT GREEN HILL[1]—Christian

Louisiana

CAMPTI*[1]—Nachitoches
COLLINSTON*—Morehouse
COUSHATTA*[1]—Red River
DOWDEN CREEK—Vernon
FLORIEN—Sabine
HANNA*[1]—Red River
LITTLE SANDY CREEK—Vernon
MONROE NORTH—Ouachita
MONROE SOUTH—Ouachita
MONROE SOUTH*—Ouachita
NEGREET—Sabine
NEWLLANO—Vernon
PEASON—Sabine
PROVENCAL*[1]—Natchitoches
WEST MONROE NORTH—Ouachita

Louisiana-Texas

HADDENS—Vernon
NEGREET*—Sabine
SALTER CREEK—Sabine

Maryland

BRISTOL[1]—Anne Arundel
DAVIDSONVILLE[1]—Anne Arundel
HUGHESVILLE[1]—Charles
KENSINGTON—Montgomery
UPPER MARLBORO[1]—Prince Georges

Maine

AUGUSTA*[1]—Kennebec
NORRIDGEWOCK*[1]—Somerset
VASSALBORO*[1]—Kennebec

Massachusetts

FALMOUTH[1]—Barnstable

Michigan

COPEMISH*—Manistee
ELK RAPIDS*—Antrim
EMPIRE*—Leelenau
FREESOIL*—Mason
MAPLE CITY*—Leelanau
NORTHLAND*—Marquette

Minnesota

BELLE PRAIRIE—Morrison
BELLE PRAIRIE NW—Morrison
BOULDER LAKE RESERVOIR NE—St. Louis
COMSTOCK LAKE—St. Louis
FORT RIPLEY—Crow Wing
HIBBING[1]—St. Louis
MARKHAM*—St. Louis
NEWFOLDEN*—Marshall
RANDALL—Morrison
TWO HARBORS—Lake

Mississippi

BILOXI—Harrison
CHUNKY*—Newton
GULFPORT SOUTH—Harrison
OCEAN SPRINGS—Jackson
PASS CHRISTIAN—Harrison
QUITMAN*—Clarke

Mississippi-Louisiana

CAT ISLAND—Harrison

Missouri

EXCELSIOR SPRINGS—Clay

Montana

CLEVELAND*—Blaine
EDGAR—Carbon
HUNTLEY—Yellowstone
LONE INDIAN BUTTE—Sweet Grass
MONTAQUA—Carbon
SOURDOUGH SCHOOL—Sweet Grass
STEPHENS HILL NE—Sweet Grass
THE BIG SLIDE*—Carbon

Montana-Wyoming

MOUNT MAURICE*—Carbon

Nebraska

BEATRICE WEST—Gage
CLATONIA—Gage

Nebraska-Kansas
DANBURY—Redwillow
McCOOK SE—Redwillow
McCOOK SW—Redwillow
SHIPPEE—Redwillow
STAMFORD SE—Harlan
WILSONVILLE—Furnas

Nevada
BEOWAWE*—Eureka
CANE SPRING*—Nye
CURRANT MTN.*—Nye
ELKO EAST—Elko
ELKO WEST—Elko
FRENCHIE CREEK*—Eureka
FRENCHMAN LAKE*—Nye
HORSE CREEK VALLEY*—Eureka
MERCURY*—Nye
MT. BLITZEN*—Elko
PAPOOSE LAKE*—Lincoln
SPECTER RANGE*—Nye
TIMBER MOUNTAIN*—Nye
TIPPIPAH SPRING*—Nye
TOPOPAH SPRING*—Nye

Nevada-California
DESERT CREEK PEAK*—Lyon

New Hampshire
WINNIPESAUKEE*—Belknap

New Mexico
DWYER*—Grant
ESTANCIA*—Torrance

New York
BROOKLYN—Kings
ENDICOTT—Broome
HAVERSTRAW[1]—Rockland
MORICHES—Suffolk
MOUNT VERNON—Westchester
OSSINING[1]—Westchester
SAG HARBOR—Suffolk
STRYKERSVILLE—Wyoming
WADING RIVER—Suffolk
WARWICK[1]—Orange

North Carolina
ALBEMARLE*—Stanly
COLLETTSVILLE—Caldwell
MURPHY—Cherokee
OAK HILL—Burke
PERSIMMON CREEK—Cherokee
TROY*—Montgomery

North Carolina-Tennessee
McDANIEL BALD—Cherokee
UNAKA—Cherokee

North Dakota
CANDO—Towner
CANDO NE—Towner
COGSWELL—Sargent
COMSTOCK—Benson
ELLIOTT SE—Ransom
ELLIOTT SW—Ransom
STARKWEATHER SE—Ramsey
STIRUM—Sargent

Oklahoma
BIXBY—Tulsa
CLINTON*—Custer
JUMBO—Pushmataha
MOYERS—Pushmataha

Oregon
ALSEA*[1]—Benton
AMITY—Yamhill
BLACHLY*[1]—Lane
CASCADIA*—Linn
CORNUCOPIA*—Baker
CORVALLIS*—Benton
DALLAS*[1]—Polk
ECHO MOUNTAIN*—Linn
GERVAIS—Marion
MARYS PEAK*[1]—Benton
McKENZIE BRIDGE*—Lane
SARDINE BUTTE*—Lane
WALDO LAKE*—Lane
YAQUINA*[1]—Lincoln

Oregon-Idaho
HOMESTEAD*—Baker

Pennsylvania
BEDMINSTER[1]—Bucks
BENTLEY CREEK—Bradford
BOYERTOWN[1]—Berks
FAIRVIEW SW—Erie
MANATAWNY[1]—Berks
NEW CUMBERLAND*[1]—Cumberland
QUAKERTOWN[1]—Bucks
SASSAMANSVILLE[1]—Montgomery
TRAY—Bradford
ULSTER—Bradford

Pennsylvania-New York
HARRISON VALLEY—Potter

South Carolina
ANDERSON*—Anderson
ASHWOOD*—Lee
GREENVILLE—Greenville

South Dakota
BOLAND RIDGE—Custer
BUTCHER HILL—Custer
ETHAN—Davison
FAIRBURN—Custer
FAIRBURN NE—Custer
FAIRBURN SW—Custer
FARWELL NW—Sanborn
OWANKA SW—Pennington
OWANKA NW—Pennington
OWANKA SW—Pennington
ROCKPORT COLONY—Hanson
WIND CAVE—Custer

Tennessee
BEECH GROVE—Coffee
CANE HOLLOW—Grundy
COLLEGE GROVE—Williamson
CROSSVILLE—Cumberland
FREDONIA—Coffee
HERBERT DOMAIN—Bledsoe
HILLSBORO—Coffee
HOLLOW SPRINGS—Cannon
MORRISON—Warren
NOAH—Coffee
PLEASANT HILL—Cumberland

Texas
ALTAIR—Colorado
BUFFALO GAP*—Taylor
ELLINGER—Fayette
FAIRDALE—Sabine
LA GRANGE WEST—Fayette
RAYMONDVILLE—Willacy
RIO HONDO[1]—Cameron
SANTA ROSA[1]—Cameron
WEIRGATE—Newton
WEST POINT—Fayette
WILLAMAR—Willacy
WILLAMAR SW—Willacy
YTURRIA—Willacy

Texas-Louisiana
COLUMBUS—Sabine
WEIRGATE*—Newton
WEIRGATE SE—Newton

Utah
ST. GEORGE*—Washington
THE NEEDLES*—San Juan

Virginia
ACCOMAC—Accomack
DISPUTANTA NORTH[1]—Prince George
METOMKIN INLET—Accomack
VICKSVILLE[1]—Southampton
WACHAPREAGUE—Accomack

Virginia-Maryland
FALLS CHURCH—Fairfax

Washington
CLEAR LAKE*[1]—Skagit
EDMONDS*[2]—Snohomish
ELK ROCK*—Cowlitz
EVERETT*[2]—Snohomish
MT. BONAPARTE*—Okanogan
PYSHT*—Clallam

West Virginia
ELIZABETH—Wirt
GIRTA—Ritchie
PETROLEUM—Ritchie

Wisconsin
NEW LONDON*—Outagamie

Wisconsin-Iowa
POTOSI—Grant

Wyoming
DUBOIS—Fremont
ESMOND PARK—Fremont
FISH LAKE—Fremont
FIVE POCKETS—Fremont
INDIAN POINT—Fremont
KISINGER LAKES—Fremont
MASON DRAW—Fremont
RAMSHORN PEAK—Fremont
SHOSHONE PASS—Fremont
TWENTYONE CREEK—Hot Springs

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and Territories are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska
SITKA

Arizona
HOLBROOK
MESA
PHOENIX

Arkansas-Louisiana
EL DORADO

California
SAN LUIS OBISPO
SANTA CRUZ

California-Nevada
DEATH VALLEY

California-Oregon
ALTURAS

Colorado-Kansas
LA JUNTA
LAMAR

Florida
MIAMI
WEST PALM BEACH

Georgia
MACON
WAYCROSS

Kentucky-Indiana-Ohio
LOUISVILLE

Kentucky-Tennessee
CORBIN

Idaho
IDAHO FALLS

Idaho-Montana
DUBOIS

Idaho-Oregon
BOISE

Iowa-Missouri
CENTERVILLE

Kentucky-Indiana-Ohio
LOUISVILLE

Kentucky-Tennessee
CORBIN

Kansas
SCOTT CITY

Michigan
CHEBOYGAN
TRAVERSE CITY

Michigan-Ontario
ALPENA
TAWES CITY

Minnesota-Wisconsin-Michigan
TWO HARBORS

Mississippi-Alabama-Tennessee
TUPELO

Nebraska-Iowa-Missouri-Kansas
NEBRASKA CITY

Nebraska-South Dakota
ALLIANCE

Nebraska-Colorado
SCOTTSBLUFF

Nevada-California
GOLDFIELD

Nevada-Oregon
VYA

Nevada-Utah
ELKO

Nevada-Utah-Idaho
WELLS

New York
BINGHAMTON

New York-Pennsylvania
ELMIRA

Oklahoma-Kansas
ENID

Oregon
ADEL
CRESCENT

Oregon-California
KLAMATH FALLS
MEDFORD

South Carolina-Georgia-North Carolina
GREENVILLE

South Dakota-Iowa-Minnesota
SIOUX FALLS

South Dakota-Minnesota
WATERTOWN

South Dakota-Minnesota-North Dakota
MILLBANK

Utah
TOOELE

Utah-Wyoming
OGDEN
SALT LAKE CITY

Wisconsin-Michigan-Minnesota
ASHLAND

Wisconsin-Minnesota
EAU CLAIRE

Washington-Oregon
WALLA WALLA

Special metropolitan-area and vicinity maps of major United States cities are being published and distributed by the Geological Survey. These maps are prepared from standard 7½-minute maps at the scale of 1:24,000. Vicinity maps may be purchased from the Geological Survey for the prices indicated below.

HONOLULU AND VICINITY (Hawaii), 50 by 69½ inches. $1.50.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich., at 75 cents per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

5.—Lake Huron. General chart of the entire lake at 1 : 500,000 scale. (October 1958)
41.—Detroit River from a point 3 miles south of the Detroit River Light to Windmill Point, Mich., at 1 : 30,000 scale. (November 1958)
61.—St. Marys River. Lake Huron to Lake Munuscong, including Potagannissing Bay at 1 : 40,000 scale. (September 1958)
63.—St. Marys River. Head of Lake Nicolet to Whitefish Bay at 1 : 40,000 scale. Inset : Sault Ste. Marie at 1 : 20,000 scale. (October 1958)
92.—St. Marys River to Au Sable Point, Mich., and to Montreal Shoal, Ont., at 1 : 120,000 scale. Inset : Grand Marais, Mich., at 1 : 15,000 scale. (October 1958)
93.—Grand Marais, Mich., to Big Bay Point, Mich., at 1 : 120,000 scale. (October 1958)
416.—Head of Detroit River, Third Street to Gaukler Point, Lake St. Clair, at 1 : 30,000 scale. (September 1958)
931.—Grand Island, Mich., including coast from Sail Rock to Au Train Point, Mich., at 1 : 30,000 scale. Inset : Munising Harbor, Mich., at 1 : 15,000 scale. (September 1958)

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between September 1 and November 30, 1958. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington, D. C.

Alaska

U. S. Survey No. 3312—Skagway Small Tract Group
U. S. Survey No. 3530—Clear Lake Homesite Group
U. S. Survey No. 3543—Small Tracts, N. Douglas Island
U. S. Survey No. 3544—Small Tracts, N. Douglas Island
U. S. Survey No. 3557—Small Tracts, Jamestown Bay
U. S. Survey No. 3565—Tongass National Forest Boundary
U. S. Survey No. 3566—Juneau Sub-port Area

Alaska—Seward Meridian
T. 16 N., R. 4 W., Survey of section 1
T. 7 N., R. 10 W., Survey of section 6
T. 7 N., R. 11 W., Survey of part of subdivisions

Arizona—Gila and Salt River Meridian
T. 10 N., R. 15 W., Survey, part of subdivision

California—Humboldt Meridian
T. 9 N., R. 4 E., Resurvey and extension survey

California—Mt. Diablo Meridian
T. 31 N., R. 6 W., Resurvey and subdivisional survey

California—San Bernardino Meridian
T. 15 S., R. 8 E., Resurvey and subdivisional survey

Colorado—Sixth Principal Meridian
T. 9 N., R. 82 W., Resurvey, part of township
T. 10 N., R. 82 W., Resurvey, part of township
T. 12 N., R. 82 W., Resurvey, part of township

Colorado—Ute Meridian
T. 1 S., R. 1 W., Survey, part of subdivision

Idaho—Boise Meridian
T. 3 S., R. 34 E. (2 plats), Omitted land and island survey

Montana—Principal Meridian
T. 20 N., R. 19 W., Resurvey and subdivisional survey

New Mexico—New Mexico Principal Meridian
T. 13 S., R. 9 W., Independent resurvey—part
T. 30 N., R. 12 W., Resurvey and subdivisional survey

Oregon—Willamette Meridian
T. 2 S., R. 8 W., Resurvey, part of subdivisions

South Dakota—Black Hills Meridian
T. 3 S., R. 17 E., Resurvey and subdivisional survey

Utah—Salt Lake Meridian
T. 36 S., R. 8 E., Skeleton survey
T. 37 S., R. 8 E., Skeleton survey
T. 36 S., R. 9 E., Skeleton survey
T. 37 S., R. 9 E., Skeleton survey
T. 36 S., R. 10 E., Skeleton survey
T. 37 S., R. 10 E., Skeleton survey
T. 38 S., R. 10 E., Skeleton survey
T. 38½ S., R. 10 E., Skeleton survey
T. 39 S., R. 10 E., Skeleton survey
T. 40 S., R. 10 E., Skeleton survey
T. 36 S., R. 11 E., Skeleton survey
T. 37 S., R. 11 E., Skeleton survey
T. 38 S., R. 11 E., Skeleton survey
T. 38½ S., R. 11 E., Skeleton survey
T. 39 S., R. 11 E., Skeleton survey
T. 40 S., R. 11 E., Skeleton survey
T. 35½ S., R. 12 E., Skeleton survey
T. 36 S., R. 12 E., Skeleton survey
T. 37 S., R. 12 E., Skeleton survey
T. 38 S., R. 12 E., Skeleton survey
T. 39 S., R. 12 E., Skeleton survey
T. 40 S., R. 12 E., Skeleton survey
T. 38 S., R. 13 E., Skeleton survey
T. 39 S., R. 13 E., Skeleton survey
T. 40 S., R. 13 E., Skeleton survey
T. 38 S., R. 14 E., Skeleton survey
T. 39 S., R. 14 E., Skeleton survey
T. 30½ S., R. 17 E., Skeleton survey
T. 31 S., R. 17 E., Skeleton survey
T. 32 S., R. 17 E., Skeleton survey
T. 30½ S., R. 18 E., Skeleton survey
T. 31 S., R. 18 E., Skeleton survey
T. 32 S., R. 18 E., Skeleton survey
T. 33 S., R. 18 E., Skeleton survey
T. 30½ S., R. 19 E., Skeleton survey
T. 31 S., R. 19 E., Skeleton survey
T. 33 S., R. 19 E., Skeleton survey
T. 30½ S., R. 20 E., Skeleton survey
T. 31 S., R. 20 E., Skeleton survey
T. 32 S., R. 20 E., Skeleton survey

(Continued from page 107.)

of a seismic sea wave, Honolulu notifies the warning centers which then put into action their own plans for warning the local area.

Throughout the operation speed is the predominant factor since the sea waves travel at speeds of up to 600 mph in the open ocean. Waves may strike a point 2,500 miles away from their origin in as little as 4½ hours. For areas located close to the origin of the earthquake the system is not effective as the wave would arrive in a few short minutes and before a warning could be issued.

In the past, seismic sea waves have been popularly referred to by the term "tidal wave." Aside from being technically incorrect, because they are not related to tides, the term misleads the public into thinking of it as one huge wave. More than one death has resulted from this misconception. Actually seismic sea waves are a series of long waves sometimes 12 to 20 minutes apart, and the first wave is seldom the largest.

In the last 40 years, 37 seismic sea waves have been recorded in the Pacific, 16 of them since 1950. The value of the warning service was proven on November 4, 1952, when a great wave struck the Hawaiian Islands. This time no lives were lost, and property damage was estimated at only $800,000. The most recent crucial test for the system was in March 1957 and equally good results were obtained.

Several other countries bordering the Pacific Ocean have expressed an interest in joining the system. One of these is Canada whose proximity to the birthplace of many sea waves—the Aleutian Islands—will make rapid communications all the more necessary. Russia's interest in the cooperative warning system was expressed to Captain Elliott B. Roberts, Chief of the Survey's Geophysics Division, during a recent meeting in Moscow of the Special Committee on the International Geophysical Year.

Comment and Discussion

NONHALATION SURVEY MARKER LIGHT

BERT B. GREEN*—The problem of marking survey stations for night shooting had become quite troublesome during extensive operations in the Neutral Zone, Persian Gulf. The standard incandescent lights were not suited for close order work because they presented too much halation when cut in with T2 theodolites, and, therefore, the required accuracies could not be obtained.

A fluorescent lamp was used in place of the standard marker lights and the results were quite remarkable. The fluorescent lamps did not "bloom" or appear as a halation in the optics of the instruments and provided a marker that could be cut in very accurately. The instrument could be cut on either side or the center of the lamp tube. This was possible because the lamp appears as a vertical strip of white color with sharp definition and no halation effect whatsoever.

The lamps were powered by storage batteries and convertors. The convertor raises the voltage from the battery sufficiently to cause ionization of the gas in the lamp, and it will produce light of an intensity strong enough to be seen for at least 30 miles. The physical characteristics of the light make it stand out very clearly against a background of other lights, such as those along coast lines or in settled areas.

A normal installation will operate approximately 10 to 18 hours when powered by a standard fully charged car storage battery.

* Manager, Marine Division, Pipe Line Technologists, Inc., 3431 W. Alabama (P. O. Box 22146), Houston 27, Texas.

❦ ❦ ❦

Dam'

The following is quoted from the Annual Report Issue of the *Canadian Surveyor,* 1958, page 166. A lot of us have, at one time or another, felt this same way at the end of a long, hard day, but we were usually rarin' to go again by the next morning.

—EDITOR

"Readers will recall our mentioning that Mr. Thistlethwaite has a poem for publication. We are very happy to be able to present this gem at last. We hasten to state that Mr. Thistlethwaite did not write the poem. He received it from Mr. S. G. Hancock, O.L.S. Mr. Hancock also disclaims authorship. We regret that we are, therefore, unable to place the credit for this masterpiece wherever it belongs. Here, however, is the poem, with comment, just as it came to us.

"Here's how one of our correspondents sometimes feels:

Dam' the country we came through,
Dam' the country we're going to;
Dam' the river, dam' the lake,
Dam' the trail we're going to take;
Dam' the flies, dam' the weather,
Dam' surveying altogether!

(Author unknown)."

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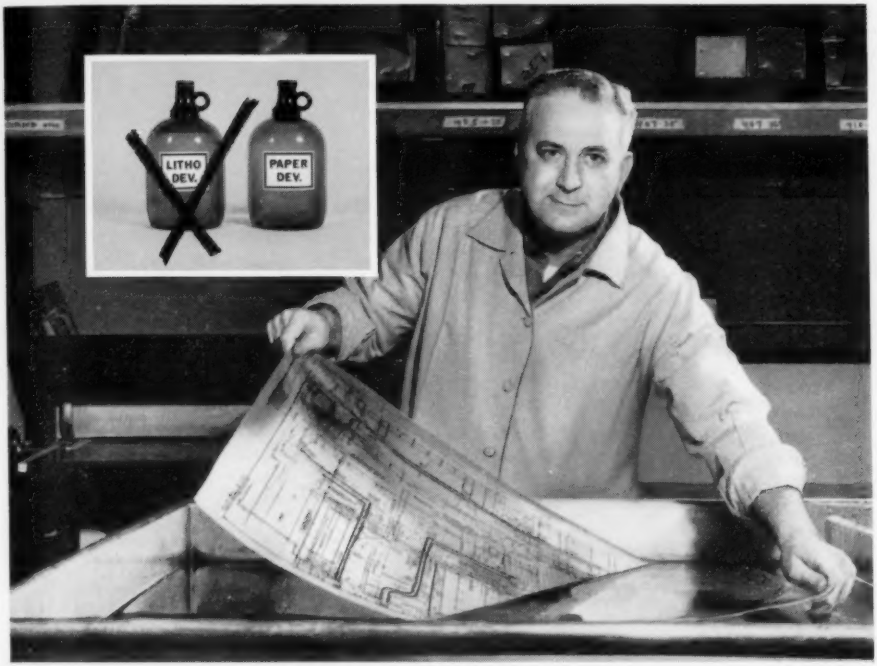

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Abstracts of Articles on Geodesy and Related Fields

The Army Map Service, of the Corps of Engineers, U. S. Army, publishes quarterly a series of processed sheets under the title: "Abstracts of Articles on Geodesy and Related Fields." The following are excerpts from the issue bearing the date of October 1958 and are selected for reprinting in SURVEYING AND MAPPING as being of possible interest to a considerable percentage of our readers. The selection has been somewhat arbitrary, and only those abstracts believed to be of quite general interest have been included. —EDITOR

441 *The Gravity Correction in Geometric Leveling* (Beitrag zur Schwerekorrektion Geometrischer Nivellements). Hellmut Bodemueller

The theoretical part of this study covers uniform derivations of the fundamentals and the manifold forms of expressions of the gravity correction for geometric leveling. The dynamic and orthometric corrections as well as the theoretical loop closing error were expressed by observed gravity values, gravity anomalies and regular gravity; developing several relations for each correction term. Practical demands as they arise in measurement and computations and the study of the quantitative relationship were given preference. Various degrees of approximation were developed for the rigorous corrections and special systems of "scientific working elevations" were investigated. A detailed discussion of the idea of an elevation, the gravity reduction, the curvature of the plumb line, and several other problems were to show the fundamental interconnection of the problem of the gravity correction in geometric leveling and other geodetic problems.

The quantitative studies essentially confirm the findings made to date regarding the value and behavior of leveling corrections, but also show that the quantitative relationship still needs very detailed and systematic investigation. The results of the investigations discussed show that the gravity corrections, in the majority of the cases considered, follow essentially a regular pattern of behavior. The coincidence of sharply sloping terrain with large gravity disturbances is possible in nature but very rare.

In agreement with other authors, the following suggestions are made with regard to the systems of elevations to be used:

1. *Dynamic elevations* in the form of geopotential heights should be determined exclusively for scientific purposes and for those rare cases where they are absolutely necessary.

2. Otherwise, *orthometric elevations* should be used in principle, in which case gravity corrections should be determined according to Niethammer, Helmert, or by means of regular gravity, or may not even be considered at all. In the first two cases, available gravity charts should be used whenever possible. No general decision can be made at this time as to when any specific degree of approximation is applicable. However, it is to be expected that Niethammer corrections will have to be used in the high mountains, at least for some principal lines. Otherwise, Helmert corrections will always give the optimum results with regard to the expense involved. The deciding factors here are the real magnitude of those portions of the corrections dependent on the course and the eliminations because of the approximation selected.

3. Scientific working elevations as given in equation (138) should not be used for the time being. While they have great practical advantage, they should be used only when orthometric elevations can no longer be useful, which could occur only if the disregarded portion of the correction which is *independent* of the course increased the portion that is dependent on the course in the majority of cases or, furthermore, were so great that it could be felt in technical leveling. Both these criteria, however, cannot yet be considered as fulfilled.

4. The theoretical loop closing error, in principle, should be computed from measured gravity values or gravity values scaled from gravity charts, until it has been established in which cases the loop closing error on the spheroid is of sufficient accuracy.

DEUTSCHE GEODAETISCHE KOMMISSION BEI DER BAYERISCHEN AKADEMIE DER WISSENSCHAFTEN, Publications Series A: Geodesy, -AMS-GL-B 664.2200, No. 26 (1957) -ms

442 *The Precision of Readings on the Plane Parallel Plate of Precise Levels* (Ueber die Genauigkeit der Planplattenanzeige bei Feinnivellieren). Edmund Camphausen

The plane parallel plates of modern precise levels are moved by a very simple linkage proportional to the tangent of the angle of rotation of the service drum; the drums which indicate the parallel shift of the line of sight are divided into equal graduations. Due to the optical-mathematical qualities of this plane-plate micrometer, the drums can give only an approximation of the shift in the line of sight. By suitably selecting the drum graduation—so that the indication acording to equation (4) is $v' = p\frac{n-1}{u}$tgα—very accurate results are obtained. With a thickness of the plate $p = 25$ mm, indices of refraction from $n = 1.50$ to $n = 1.60$, and tipping angles of up to 30%, the maximum errors in the reading are from 0.03 to 0.04. If the value $\frac{n-1}{n}$ in (4) is changed to $\frac{n-1}{n} = dc$, so that positive and negative maximum errors are obtained, the maximum error amounts to only 0.01 mm. These values are certainly acceptable for precise leveling, since they are within the range of sighting precision; they furthermore cancel each other out to a large extent.

ZEITSCHRIFT FUER VERMESSUNGSWESEN (German)-AMS-GL-B 664.7001, v. 83, No. 3 (1958)-ms

443 *The Accuracy of Angle Observations* (Die Genauigkeit der Winkelmessung) F. B. Ording

The economy of observation methods is closely tied to the various types of instruments. When using simple reading equipment, the repetition method has certain advantages although containing certain deficiencies. The greatest deficiency is the possibility of carry-over.

The paper discusses the propagation of errors in various observation methods and shows how the various standard errors enter into the final result. The closing error can also be derived without the usual differentiation of the angle function through some direct, simple considerations. A few examples are given.

The numerical examples show that the theoretical advantages of the repetition method are substantially reduced for precise instruments. The method may be recommended only if it is necessary to obtain fairly high precision with simple instruments.

ALLGEMEINE VERMESSUNGSNACHRICHTEN (German)-AMS-GL-B 664.7002, No. 2 (1958)-ms

446 *A New Comparator for Leveling Rods* (Uj ezintezoleckomparator). E. Rogoczi

The calibration of leveling rods against invar tapes still is encumbered by some uncertainties even when using standard invar meter bars equipped with microscopes. These uncertainties are mostly due to the following factors: (1) the graduations on the invar tape of the rod are very rough as compared to the graduations of the standard; (2) when the standard is mounted on the invar tape, this shrinks slightly (13μ per meter); (3) the rod is horizontal during calibration, but vertical during the measurement. According to Hungarian tests, this latter case brings about an expansion of 3.5μ.

In order to mechanize the calibration in the laboratory and increase the accuracy, the Hungarian Pusztay constructed a new optical comparator. The calibration starts with aligning the base of the instrument. For this purpose the end graduations are brought to coincide with the plane-parallel plate and the corresponding reading is corrected by the difference between the standard and the legal meter. For the calibration of the rod, the graduations are then successively brought into coincidence with the plane-parallel plate and readings are made on the micrometer.

For mechanical rod calibration, the eyepiece is replaced by a photographic camera and the rod is moved by an electric motor. The magnitude of the move is set according to the distance between graduations and the camera takes a photograph after every move of the rod; the camera release is coupled to the electric motor. The graduations, in this case, are read on the photographs. While the new comparator should eliminate the uncertainties under (1) and (2) the uncertainty under (3) so far as it has any effect at all, is not yet eliminated. The comparator is therefore to be changed in such a manner that it can be used for calibrating the rods in a vertical position.

GEODEZIA ES KARTOGRAFIA (Hungarian)-AMS-GL-B 661.7200 v. 9, No. 1–2 (1957)-ms

450 *Graphic-numerical Adjustment of Secondary Triangulations. Determination of Points by Multiple Resection* (Compensazione grafico-numerica delle triangolazioni secondarie. Determinazione di punti per intersezione multipla indietro). Major Guiseppe Birardi.

A new method for the determination of a point by multiple resection is presented. The

problem is solved by a semigraphic method in a similar manner as for the problem of isolated fixed points observed both from inside and outside.

The first phase consists of establishing an approximate valuation for the internal orientation. This valuation is obtained by attributing the character of observed anomalies to those deduced by a rigorous solution of a simple resection obtained from the multiple one.

Thus the position of the approximate point is obtained at the same time.

The next phase is to proceed by means of variation of coordinates, adjusting graphically the figure of error by the method of symmetrical barycenters. In this case, the procedure is very simple.

A comparison between the results obtained numerically and graphically is also presented.

Bollettino di Geodesia e Scienze Affini (Italian)-AMS-GL-B 641.2200, v. 16, No. 4 (1957)-ma

452 *Research on the Precision of the Kern DKM 3 Theodolite* (Ricerche sulla precisione dei teodoliti Kern DMK 3). Dr. Mario Fondelli.

The IGM obtained and tested three Kern DKM 3 double circle theodolites. The test and research were carried out in order to determine the intrinsic precision and the precision relative to the use of the Kern DKM 3 theodolite in geodetic operations.

After a very detailed description of the theodolite and the recapitulation of the methods and the procedure used for the experimental research, the results and the conclusions are reported.

Of particular interest is the test of the graduation system of double-circle. The new system permits obtaining very good results in angular measurement, noticeably reducing the influence of the periodical errors in the graduation.

The system of reading by "symmetry," instead of by "coincidence," permits obtaining rather small mean errors of reading. The obtained errors of centering were equal to about 1/30 of the sensitivity of a mark of the collimation zenithal levels.

The Kern DKM 3 theodolite proved to be a simple and practical instrument, the errors of the micrometer scale graduation being so small that they can be neglected. The instrument meets the requirements set for highly accurate geodetic operations.

Bolletino di Geodesia e Scienze Affini (Italian)-AMS-GL-B 641.2200, v. 15, No. 4 (1956)-ma

455 *Accurate Determinations of Astronomic Azimuth Based on the Observations of Polaris* (Wyznaczenie dokladnego azymutu asotronomicznego z obserwacji Polaris). Blazej Dulian

Polaris is well situated for determinations of astronomic azimuths, for it permits observations not only during the night but during daylight as well.

Like every method the Polaris method has certain disadvantages. The most negative of them is the influence of the inclination of the horizontal axis of the astronomic theodolite. Then, the changes in the position of the axis due to the harmful tension of forces during the revolution of the telescope around the axis.

The mobile thread of the ocular micrometer of the Wild T 4 astronomic theodolite causes a new factor of influence. The new factor was previously neglected.

A special operation is suggested in order to reduce the influence of the changes occurring in the position of the axis of the telescope during observations. For such a reduction a special table was computed.

Prace Instytutu Geodezji i Kartografii (Polish)-AMS-GL-B 676.2600, v. 5, No. 1 (1957)-ma

458 *A Method for the Simultaneous Determination of the Run of Micrometer and of the Mean-square Accidental Graduation Error* (Metoda jednoczesnego wyznaczania runu i sredniego bledu prazypadkowego podzialu kól.) Jerzy Szymonski

This article presents a new, practical, and economical method of determining the mean-square accidental error of the graduations of the horizontal and vertical circles. The method is based on the proposition that the adjacent graduation marks on a circle are subject to systematic errors of an equal magnitude. This type of circle-graduation errors has no influence on the value of the run of micrometer.

By evaluating the run at various symmetrical places on the circle it is proved that the differences between the values thus obtained are caused particularly by the accidental graduation errors and, to a certain extent, by the errors of eccentricity between the circle and the level as well as by observation errors. By eliminating the influence of the errors of eccentricity and errors of observations, we can find for a given circle the maximum mean-square accidental

error of graduations (possibly also of the diametrical graduations).

This method is particularly suitable for examining instruments having an optical reading system with the graduation of the optical micrometer extended beyond its initial and final graduation marks. Basically, the method consists of measuring the smallest interval on the circle graduation. We can consider as the interval the angle comprised between the pairs of graduation marks which form a double graduation mark.

The new method, illustrated by a numerical example, permits a considerable reduction in the observation time, but the accidental graduation errors can only be estimated. Therefore, it is advisable to measure the angle between the pairs of graduation marks near the same place of the micrometer graduation.

GEODEZJA I KARTOGRAFIA (Polish)-AMS-GL-B 676.7300, v. 6, No. 4 (1957)-ms

460 *Precise Leveling and Gravimetry* (Praezisionsnivellement und Schweremessung). Axel Jessen

When a closing error of 1.186 m. was noted in a loop of the Swiss national leveling in 1870, the discussion of the gravity reduction in leveling began. It was proposed to correct the leveling for the error resulting from the nonparallelism of the earth's reference surfaces. But at that time relatively few gravity values were available, thus the possibility of practical application was very limited. However, the construction of modern gravimeters reopened this discussion.

The basic idea today is as follows: the sum (Σh) of the elevation differences along a level line is not independent of the course, while the sum (Σgh) of the potential differences is independent. Therefore, the "correct" elevation difference H gives the measured potential difference:

$$GH = \Sigma gh \qquad (1)$$

However, several different values can be selected for G and thus one can obtain dynamic elevation, orthometric elevation, Niethammer elevations, etc. In any case values for G were arbitrarily selected. It seems that something is fundamentally wrong in the manner in which the equation (1) is applied. Now the problem is how to state the nonparallelism of the reference surfaces. In order to solve the problem one must combine properly established leveling with gravity measurements. It is then possible to determine the evaluations of individual points as well as the positions and inclinations of the reference surfaces with regard to each other.

Therefore, equation (1) is superfluous. One has to use the potential differences to find those points which are located on one and the same reference surface.

There is no obligation to seek corrections for the nonparallelism of the reference surfaces. The real value of a leveling net only becomes established when the net is compared with its earlier or later leveling of equal quality. There is a possibility that gravity corrections are not needed for this purpose, for they will have the same values for the same points and can therefore be eliminated. However, due to the fault of the historical development this method can hardly be used for the first-order leveling nets with large loops.

SCHWEIZERISCHE ZEITSCHRIFT FUER VERMESSUNG, KULTURTECHNIK UND PHOTOGRAMMETRIE (German)-AMS-GL-B 644.7200, v. 55, No. 8 (1957)-ma

465 *The Changes in the Mean Latitudes of Poltava, Mizusawa, Richmond and Washington* (Izmeneniya srednei shiroty Poltavy, Mitsuzavy, Richmonda i Vashingtona). E. E. Obrezkova

In order to show what causes significant changes in mean latitudes, special research was carried out. The observations carried out by two instruments located at Poltava and Mizusawa respectively were analyzed. In addition, a comparison was made with the latitudinal changes at Richmond and Washington, for these two stations are approximately located in the same meridian.

An analysis was made of the dependency of such changes upon various programs applied and instruments used in observations.

It was concluded that the mean latitudinal changes appear in the form of very irregular waves. Such changes do not depend upon observation programs, but rather upon certain defects of the instruments. These defects are causing a systematic accumulation of errors of observation. Furthermore, these errors are causing fictive changes in the mean latitudes which sometimes result in serious obstacles. Since the degree of changes depends upon the instruments used in observations, it is necessary to exclude these errors instantly, i. e. before the initiation of the computation of the earth's pole coordinates. That, unfortunately, the Central Bureau of the International Latitude Service has not yet done.

ASTRONOMICHESKIY ZHURNAL (Russian)-AMS-QB1-A86, v. 34, No. 3 (1957)-ma

466 *The Influence of Diurnal Aberration on the Accuracy of Latitude Determinations from Observations of Palaris* (O vliyanii sutochnoi abberatsii na tochnost opredeleniya shiroti mesta po polyarnoi zvezde). V. F. Dyakonov

An analysis was carried out on the influence of diurnal abberation on the equatorial coordinated (α, δ) of Polaris. For such an analysis the following formulae of Prof. M. K. Wentzel were used:

$$\Delta\alpha = 0''.32 \cos\phi \sec\delta \cos t$$
$$\Delta\delta = 0''.32 \cos\phi \sin\delta \sin t$$

On such a basis a report was made on the accuracy of latitude determinations of the second-order astronomical points based on the observations of Polaris. The mean-square error of latitude determination for second-order astronomical points must not exceed $\pm 0''.4$.

It was proved mathematically that the influence of diurnal aberration may cause an error (when $t < 90°$) in latitude of $\pm 0''.5$. Therefore, it was recommended that in the computation of observation results the influence of diurnal aberration on the determination of latitude from observations of Polaris be taken into consideration.

Astronomicheskiy Zhurnal (Russian)-AMS-QB1-A86, v. 34, No. 3 (1957)-ma

474 *The Lunisolar Influence on Leveling of a High Order of Accuracy* (Utjecaj privlacnog djelovanja Mjeseca i Sunca na nivelman visoke tacnosti). S. Klak

Because of relatively low precision of leveling instruments the systematic error of lunisolar influence had not been taken into consideration at previous times. Since the modern instruments furnish, and the new methods require, a very high degree of precision and accuracy, the lunisolar influence can no longer be ignored.

A detailed analysis of the formula for the lunisolar correction in the horizontal coordinate system was presented. The new formulae, based on the formulae for the static theory of the tide, were derived and used for the transformation of the horizontal coordinate system into the equatorial coordinate system. For mathematical illustration a special table was computed for 0° to 90° latitude, where the values of amplitudinal and phase changes are also shown.

The errors appearing in the lunisolar correction were discussed. It was concluded that in order to minimize the lunisolar influence it is necessary to densify leveling nets of high order of accuracy with a greater number of bench marks. Thus the correction for lunisolar influence can be computed for an entire leveling line.

Geodetski List (Serbian)-AMS-B 658.7100, v. 11, Nos. 9/12 (1957)ma

G. P. O. Price List 53

The 48th Edition of Government Printing Office Price List 53, dated November 1958, bears the title "Maps, Engineering, Surveying." This price list, which will be furnished free of charge upon request, covers the material formerly contained in Price List 18, plus, of course, new items recently issued.

Because orders for government publications must give titles and catalog numbers of any publications which may be desired and must be acompanied by a remittance to cover the cost of the publications, the catalog covering the field or fields of interest is almost "a must" for efficient procurement of such items.

Price List 53 lists many books and pamphlets of more than passing interest to those engaged in surveying and mapping, and some that should be in the library of every surveyor. Write for your copy before you forget it. You may be surprised at the many valuable items listed as well as pleased at the very moderate prices charged for them.

Address requests for Price List 53 to : Superintendent of Documents, Government Printing Office, Washington 25, D.C.

News of Related Organizations

California Council of Civil Engineers & Land Surveyors

The California Council of Civil Engineers and Land Surveyors held its 26th Board of Directors meeting January 22 and its Seventh Annual Convention, January 23–24, 1959, at the Statler Hotel in Los Angeles.

Twenty-six directors attended the business meeting, highlights of which were the seating of delegates from a new chapter, the Civil Engineers and Land Surveyors of Riverside-San Bernardino Counties, and the election of officers for 1959.

E. Lee Scott, Los Angeles, succeeds George C. Bestor, Carmel, as President of the Council. Other officers for 1959 are: Walter J. Hanna, Jr., Gilroy, First Vice President; Charles W. Christensen, San Diego, Second Vice President; and Raymond F. Murphy, Redwood City, Secretary-Treasurer. William A. White was reappointed executive officer and his title changed to Executive Director.

The convention was attended by 155 members, very nearly 50 percent of the Council membership, and 130 ladies were in attendance. The technical sessions were lively and developed much local interest. There were three television programs and one editorial in a local paper which arose out of convention discussions.

WILLIAM A. WHITE
Executive Director

Georgia Association of Registered Land Surveyors

The 1959 Surveying and Mapping Short Course, sponsored by the Georgia Association of Registered Land Surveyors, and conducted by the School of Civil Engineering of the Georgia Institute of Technology, through its Extension Division was held at Atlanta, Georgia, January 29–31, 1959.

The tentative outline for the course—all that was available when this was written—included a wide range of subjects, as follows:

Perculation Test to Meet Requirements of State of Georgia.

Theory and Design of Oxidation Ponds.

Theodolite and Subtense Bar, Geodimeter, and Tellurometer.

Photogrammetry as a Help to Surveyors.

Office and Field Costs.

Ethics and Practice.

State Plane Coordinates and How to Convert to Latitude and Longitude and Vice Versa.

Lien Law.

Plan and Map Reproduction.

Thursday evening, following a meeting of the GARLS, "Polaris Observations and the Effect on Convergence."

Saturday morning's program included a lecture on "Solar Observations," followed by a demonstration of both observations and calculation of results.

The banquet and entertainment was held Friday evening.

Indiana Society of Professional Land Surveyors

The Indiana Society of Professional Land Surveyors held its Fall Meeting of Committees, Friday evening and Saturday morning, November 7–8, 1958, at the Turkey Run State Park. Almost all of the committees were in action. During a special group meeting, most of the chairmen made reports which were accepted and, in some cases, implemented by authorization to proceed.

The ISPLS has published an 8¾ by 12-inch sheet, designed to fold in thirds for easy mail-in, and bearing the title "How to Secure the Services of a Land Surveyor." This little brochure bears a remarkable resemblance in content, if not in format, to a similar one issued under the same title by the Massachusetts Association of Civil Engineers and Land Surveyors. (*See* SURVEYING AND MAPPING, October–December 1958, Vol. XVIII, No. 4, page 444.)

The publication of a *Yearbook-Directory* of the ISPLS was also authorized. This was in the hands of the printer in December 1958, was scheduled for publication in January 1959, and is to be sold to the membership of ISPLS at cost.

Joint Meeting in New Jersey

The 19th Annual Land Surveyors Conference and Exhibition, sponsored by the Board of Directors of the Land Surveyors Division of the New Jersey Society of Professional Engineers, was held January 17, 1959, at University Commons, Rutgers University, New Brunswick, N. J. This session became a landmark in the long history of these conferences because for the first time it was conducted as a simultaneous meeting of the Land Surveyors Division of the New Jersey Society of Professional Engineers and the New Jersey members of the American Congress on Surveying and Mapping. Despite inclement weather, a near record attendance of 291 was attained.

Dr. Elmer S. Easton, Dean of the Rutgers College of Engineering, delivered an address of welcome to the surveyors. Greetings on behalf of the NJSPE were offered by President Clifford W. Zimmer, P.E. Robert P. McEldowney, Jr., P.E. & L.S., discussed the formation of "grass roots" surveying units at the local chapter level.

A panel discussion of New Jersey Assembly Bill No. 206 relating to registration and licensing of Planning Consultants, moderated by Thomas F. Bliss, P.E. & L.S., presented John Geiger and Isadore Candeub who spoke for the planners. Charles V. Bonhag, P.E., chairman of the NJSPE committee which is studying this bill, and H. Thomas Carr, P.E. & L.S., presented the views of the engineers and surveyors.

The afternoon session was highlighted by an address by A. Phillips Bill, of Massachusetts, Chairman, Property Surveys Division, ACSM. Mr. Bill outlined the national organizational structure of ACSM and detailed the composition of the local units in Massachusetts. He stated that the foundation of surveying progress was at the "grass roots" level and urged the formation of local units in New Jersey. Mr. Bill complimented the New Jersey group for their outstanding professional development during the past 35 years and recommended that the experience gained during this period of progress be made available to younger organizations. He stressed the fact that, although the New Jersey surveyors were near the top in professional development, they could benefit by following closely the activities in other States. He strongly urged affiliation with the ACSM, which acts as a coordinating unit. The subject of affiliation with ACSM has been discussed and given favorable consideration by the New Jersey group.

Edward A. Bonus reported completion of the revisions to the New Jersey Map Filing Act to be presented to the legislature this year.

W. Hall Clarke reported that the Attorney General has been asked for a ruling on the legality of the preparation of municipal tax maps by unlicensed, out-of-State, groups.

The New Jersey Society of Professional Engineers was organized in 1924, principally by civil engineers and land surveyors. The surveyors have been an integral part of the organization ever since. In the early years the surveyor members functioned through a large State committee. After several years of consideration, the Land Surveyors Division was officially created in 1935 to enlarge and expand the activities of land surveyors within the framework of the NJSPE. It operates basically as a "functional section." However, it antedates the fostering of the functional section by the National Society of Professional Engineers by several years.

In addition to the 550 surveyor members of the Society, the Division officers and the Board of Trustees stand ready to aid the 1750 licensed land surveyors in New Jersey in matters of fees, salaries, legislation, and all problems relating to surveying.

The Division officers and committee members in charge of the conference included Michael A. Canger, Jr., Division Chairman; William L. Wissing, Conference Committee Chairman; Professor Paul P. Rice of Rutgers University, Executive Secretary; Ted C. Frank, Vice Chairman of the Division; Robert P. McEldowney, Jr., Treasurer; Robert Doolittle and Thornton Garlick, Secretaries. Professor Rice, who is also Vice Chairman, Property Surveys Division, ACSM, has been the motivating force behind these conferences for many years.

Exhibits at the conference accentuated the new advances in surveying instruments, equipment, and methtods, both in land and aerial surveying. A table of ACSM literature, including membership application blanks, was prominently displayed. Literature on the NJSPE was also made available to nonmembers of the society.

—THORNTON GARLICK
Corresponding Secretary, LSD–NJSPE

("News of Related Organizations" continued on page 143.)

Congress News

For publication in SURVEYING AND MAPPING and for ACSM records, the Executive Secretary and the Editor need your reports of annual elections as quickly as possible in order to meet our publication deadlines. Reports of meetings and other activities throughout the year should also be forwarded without delay. Even the relatively short items which are included in this department should be in the hands of the Editor not later than the end of the first month in the quarter to insure publication in the issue published during the third month of the quarter. —EDITOR

Western U. S. Conference

On October 9, 10, and 11, 1958, over three hundred surveyors and civil engineers of the Western States and Alaska met, and witnessed California's annual Surveyor's Workshop of Monterey blossom into the Western Regional Conference.

Also registering were about two hundred accompanying wives and over one hundred guests, who came to enjoy Monterey's climate, hospitality, and history. Many of the guests were in allied work such as photogrammetry, geology, and mining engineering.

Eighteen exhibitor-supporters showed many of the new developments in the instrument and equipment field of surveying and photogrammetry, including products of the leading American and European manufacturers.

The majority of the speakers and panel members came from the eight Western States, arriving by highway and air, with a few piloting their own planes. Also, several top-ranking officials of Federal and State agencies were guest speakers, imparting a great deal of professional knowledge to those in attendance.

Probably the most noted speaker was Dr. W. Schermerhorn of Delft, Holland, Dean of the United Nations-sponsored International Center for Aerial Survey. Prof.-Dr. Schermerhorn at one time served as Prime Minister of Holland.

The theme of the Conference was "Accuracy and Economy," although, as the program developed, it seemed to many that it should have been "Accuracy *Versus* Economy," for the two were shown to be antagonistic.

The field demonstrations were of especial interest. A great deal of new equipment was exhibited, including the Geodimeter the Tellurometer, the MicroDist, Gurley's Electronic Distance Measure, Motorola's surveyor's walkie-talkie, and a portable tape recorder to replace a field man. Among the more conventional instruments demonstrated were the newer European transits (theodolites) and levels, including the new Zeiss theodolite which will go on sale soon.

Some of the field demonstrations had practical application to the average private surveyor A precise taping team from Oakland's East Bay Municipal Utilities District and a team from the Army Engineer Corps using the American plane table and alidade made an excellent map of the Fairgrounds on the spot, complete and ready for reproduction.

In the office equipment shown and demonstrated, the great advances appear to be in reproduction and computation equipment, which improves from month to month. The use of the complicated office equipment was covered in the panels of qualified operators from IBM, Remington Rand, employees of the California Division of Water Resources, the State Highway Commission, and some from private practice. Although these speakers confined most of their discussion to the more complicated machines afforded only by larger offices and professional computing organizations, some of the examples had practical application in the smaller office and in everyday field and office computation.

An interesting motion picture entitled "Property Line" was shown in conjunction with the field demonstrations.

The Conference was no less a sucess socially than it was in other respects. On Friday, two bus loads of over one hundred wives took the famous tour of old Monterey landmarks, driving over the scenic 17-Mile Drive, with stops at Pebble Beach, old Carmel Mission, and the Carmel shops. A young lady from the Chamber of Commerce acompanied the tour as guide-lecturer and gave interesting descriptions of each historic location. The group enjoyed a delight-

ful luncheon at Del Monte Lodge, arranged for under the chairmanship of Mrs. George Bestor.

The social climax of the Conference was a very gay dinner-dance, with a fine orchestra. A fashion show of ladies' attire was presented by some twenty engineers and surveyors, which kept the guests highly amused.

After the dinner, plaques were presented to ACSM Advisory Council Member William C. Wattles and ACSM Vice President George C. Bestor for their outstanding service to the American Congress on Surveying and Mapping.

In a brief narrative report it is impossible to cover all of the activities, the papers given, and the exhibits. It was a grand show, put on after months of preparation and effort. All in attendance learned much that will assist them in the everyday operation of office and survey party management. Most of us returned home with the feeling that we had been in close contact with the latest thought in surveying and its instruments and equipment, and with the hope that our officers can make this an annual event at Monterey.

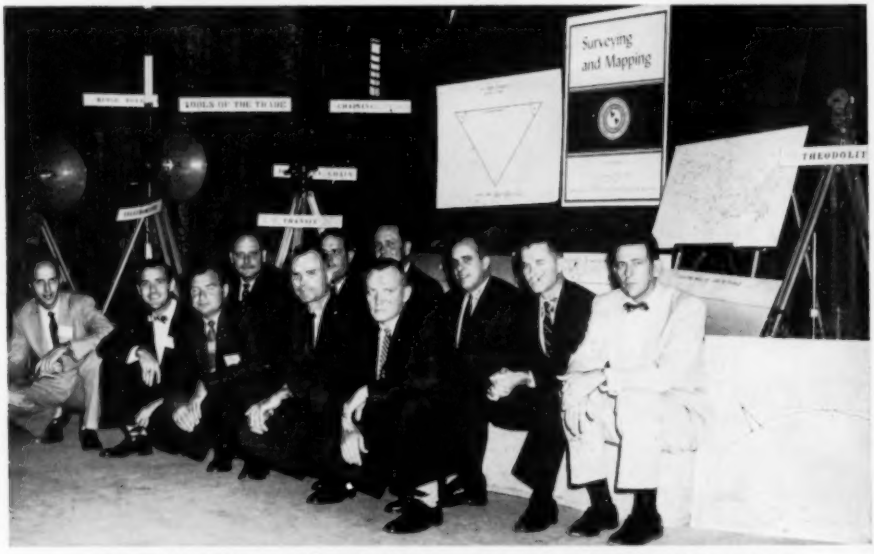
—PAUL J. DOWLING, *Editor, Southern California Section*

Louisiana Section

During the recent observance of Oil Progress Week in New Orleans, the Louisiana Section was one of 25 organizations and firms that sponsored exhibits in Tulane University Sugar Bowl Stadium. The various exhibits, designed to stress the importance of science to the oil industry, were presented in such a manner as to attract the many hundreds of junior and senior high school students from greater New Orleans who viewed the three-day display.

The ACSM booth, manned by various members of the Louisiana Section, stressed the importance of geometry and trigonometry and their application to surveying problems. With the aid of a series of cartoons and posters, a twelve-minute commentary was presented to each group of students viewing the exhibit. An extensive display of surveying equipment was made possible by various members of the Section and the firms with whom they are affiliated.

The regular quarterly meeting of the Section was held in the New Orleans Engineers Club on October 27, 1958. Following a cocktail hour, Vice Chairman R. C. Dayton conducted



LOUISIANA SECTION MEMBERS AND EXHIBIT AT THE SUGAR BOWL STADIUM

Front row, left to right: Johnny Walker, R. E. Burnside, Jr., E. L. Dewailly, C. E. Felder, and Joe Rainey. *Back row:* W. J. Lecompte, Coleman Kuhn, C. E. Bridges, *Section Chairman*, C. F. Greene, H. G. Truelove, and J. L. Hicks.

the business meeting and called upon former Chairman George Jones to introduce the speaker, N. C. Roberts, Jr., Consulting Meteorologist, of New Orleans. Mr. Roberts' talk on the weather, its relationship to the surveyor and to industry, was most informative and was well received by the group.

—H. G. SNEED
Section Secretary

Northern California Section

Officers elected to serve the Northern California Section, ACSM, for 1959 are as follows:

Chairman—W. A. Angeloni
Vice Chairman—Paul J. Dowling
Secretary-Treasurer—Daniel P. Coleman
Editor—Edward F. Kulhan
Directors—W. A. White
Charles E. Randlett

The 1959 Executive Board will consist of the above-named officers plus Past Chairman Charles O. Greenwood and holdover directors John R. Eaton and Charles R. Strang.

These officers and directors assumed their duties January 1, 1959.

The first 1959 meeting of the Northern California Section of the American Congress on Surveying and Mapping was held in the Engineering Building of the University of California, Berkeley, Calif., during the evening of January 30, 1959.

Robert E. Altenhofen, Chief, Photogrammetry Section, U. S. Geological Survey, spoke on "Photogrammetry Applied to Cadastral Surveys," and Erwin Hovde, Supervising Right-of-Way Engineer, Division of Highways, District IV, spoke on "Uncontrolled Aerial Photos as a Tool."

A report on the progress being made toward the preparation of the examination for the California Department of Professional and Vocational Standards for the land surveyor license, as well as the highlights of the 7th Annual Convention of the California Council of Civil Engineers and Land Surveyors, held January 22–24, 1959, in Los Angeles, were presented informally.

—DANIEL P. COLEMAN
Secretary-Treasurer

Texas Section

The Texas Section held its third quarterly meeting of the year on September 19, 1958, at John's Restaurant in Houston. Ninety-one members and guests were present, including several members of the Texas Surveyors Association.

After the excellent dinner which preceded the meeting, Chairman Cornitius outlined a proposal, previously discussed by the Executive Board, that the Section affiliate with Houston area members of the Texas Surveyors Association for the purpose of holding joint meetings. Ed Morse, who with Tom Dillon had acted as a fact-finding committee, reported that there are about 118 TSA members in the Houston area who are not members of ACSM, and expressed optimism about the prospects of such an affiliation since the organizations have common objectives.

J. S. Boyles introduced the guest speaker, Hon. Bill Allcorn, Commissioner of the General Land Office of the State of Texas. This position or office has a unique distinction in that the State of Texas retained title to all public lands when annexed to the United States in 1845. The General Land Office was founded in 1836, nine years before the annexation, and is charged with the responsibility of administering and disposing of all public lands in the State as well as the handling of the Veterans' Land Porgram. Mr. Allcorn gave a very interesting talk on the efforts of the Land Office in preserving original documents, many of which are over 130 years of age. He discussed in particular the method of "laminating" a document between plastic sheets to prevent further deterioration and facilitate handling, and the microfilming of all correspondence in further efforts at preservation of valuable records.

—ELLIS S. ALLEN
Section Editor

The annual meeting of the Texas Section, American Congress on Surveying and Mapping, was held Friday, December 5, 1958, at John's Restaurant, 9350 South Main Street, Houston, Texas. This was a dinner meeting and Chairman Leonard E. Cornitius presided.

Following the report of the Treasurer, Howard E. Bush, Jr., Chairman Cornitius reported on the activities of the Section for the past year and commended his fellow officers and committeemen. All four meetings were dinner meetings, and speakers were chosen to present papers of general interest. A movement is on foot to form a Harris County Chapter of the Texas Surveyors Association and to hold joint meetings with, or affiliate with, the Texas Section of ACSM.

Program Committee Chairman, John Phillips, reported and thanked the members of his committee for their work during the year.

L. P. Carr, Chairman of the Membership Committee reported a total membership of 231, with 170 having paid their Texas Section dues.

New officers for 1959 were elected, as follows:

Tom Dillon, *Chairman*
C. J. Montgomery, Jr., *First Vice Chairman*
Glenn E. Musselman, *Second Vice Chairman*
Howard E. Bush, Jr., *Third Vice Chairman*
Howard C. Taylor, *Secretary*
John H. Brownlee, *Treasurer*
James W. Terry, *Director*
B. D. King, Jr., *Director*

Holdover or automatic directors are Leonard E. Cornitius, Robert E. Crosser, John C. Lipscomb, and Ellis S. Allen.

The meeting was turned over to the incoming chairman, Tom Dillon, who spoke briefly and then adjourned the meeting, following a rising vote of thanks to retiring chairman Cornitius.

The above was abstracted from a much more detailed report supplied to Executive Secretary Dix by G. E. Musselman, Secretary, Texas Section, ACSM. —EDITOR

North Carolina Section

The second regular meeting of the North Carolina Section was held November 8, 1958, at Charlotte, N. C., with ten members in attendance.

Chairman Kirkman reported that, at a meeting of the Executive Committee on October 18, 1958, in Charlotte, N. C., the Constitution and Bylaws of the North Carolina Section, ACSM, as approved by ACSM on September 5, 1958, had been accepted. The Section is now fully organized and is composed of 32 active members.

W. Thompson Cox was appointed Authorized Representative for the Section and Section Advisor to the Property Surveys Division of ACSM for a period of two years.

After some discussion, it was agreed that a resume of the aims, purposes, etc., of the North Carolina Section be compiled and a copy sent to all Registered Engineers practicing land surveying and all Registered Land Surveyors having residence in North Carolina, together with a copy of the membership application to ACSM, a copy of the membership application for the North Carolina Section, and an invitation to apply for membership in both organizations.

The chairman appointed four members as a committee on the Uniform Map Law. This committee is to participate in a joint committee composed of a subcommittee of the Real Property Committee of the North Carolina Bar Association and also of the PENC PS&M Functional Section Liaison Committee.

The Section fully approved and recommended that the final report of the Commission for the Study of the Uniform Map Law, which was given to the Governor September 23, 1958, be ratified by the General Assembly in the 1959 Legislature.

The following officers and directors were unanimously elected for the year 1959, by letter ballot dated October 28, 1958:

Chairman—Robert P. Guarino
First Vice Chairman—Jerry R. Mitchell
Second Vice President—Ben L. Smith, Jr.
Treasurer—Fred B. Davis
Secretary-Editor—W. Thompson Cox
Director (Two year term)
Edgar H. Kimmons
John R. Grove
John G. Bane
Director (One year term)
E. P. Fitts
George Losak

Standing Committee on Constitution and Bylaws: Edgar H. Kimmons, *Chairman*, C. B. Scott, William Leonard, and R. D. Stout.

—W. THOMPSON COX
Editor

NCS and SCS to Prepare Examination Questions

Harvey Rookus, 1958 Chairman of the Southern California Section, American Congress on Surveying and Mapping, started in motion a proposal that the two California sections of ACSM provide the State Board of Registration for Civil and Professional Engineers assistance in the preparation and grading of examinations for land surveyor's license. Charles O. Greenwood, Jr., 1958 Chairman of Northern California Section, joined Mr. Rookus in making the proposal to the Board. On December 16, 1958, Arthur I. Flaherty, Executive Secretary of the Board of Registration, wrote Mr. Greenwood and Mr. Rookus as follows (in part):

"The Board of Registration has approved the acceptance of your offer to provide assistance in the preparation of the examinations for land surveyor's license.

"It was thought that the matter might be put in motion by asking the Northern California Section to undertake this project first, aiming towards the August 1959 written examination.

Then the Southern California Section might be called upon for the April 1960 examination. The Northern Section was nominated first to provide ease in communication between the Board's Sacramento office and the office of the Northern California Section.

"It was contemplated that the Northern Section would provide material in the form of written problems and the solution to each problem. An estimate of a reasonable time required for the average applicant to solve a problem will be required in each case. From these problems, solutions, and time estimates, the Board would determine the content of the examination."

—William A. White
Secretary-Treasurer
Northern California Section

St. Louis Section

The St. Louis Section of the American Congress on Surveying and Mapping held a very interesting meeting on November 18, 1958, at which Charles Spooner, Chief, Technical Development Staff, Army Map Service, Washington, D. C., spoke on the subject of automation of cartographic processes. A very lively discussion period followed. One hundred seventeen members and guests were present.

Several business meetings have been held recently by the Board of Directors and Officers. A number of proposals have been presented in promotion of expanded participation and accelerated committee activity to encourage a strongly active Section. One activity which is well under way is a Section "Newsletter" which has not yet been named. However, the publishing group already has the machine for printing it.

—Sheridan L. Hall
Section Editor

The St. Louis Section is to be congratulated on their excellent and unique letterhead, an engraving, in which the name of the parent organization is imposed over compass rays of a chart compass rose, the east-west ray of which sights through a modern optical survey instrument. The Section name is to the right and under a sternwheel paddle steamer of the old Mississippi River type, whose smoke, drifting in lazy swirls skyward forms the script letters *"S"* and *"L"* entwined and through which passes the trace of a passing aeroplane.

—Walter S. Dix
Executive Secretary, ACSM

Utah Section

The following officers were elected to serve the Utah Section of the American Congress on Surveying and Mapping for the year 1959:

Chairman—Bert K. Steiger
Vice Chairman—Herbert P. Lee
Secretary-Treasurer—Clifford G. Bryner
Editor—Robert B. Jones

Von G. Adamson has been named chairman of the Membership Committee, and F. Wayne Forrest is chairman of the Program Committee.

The *Newsletter*, No. 1, January 1959, states that the Utah Section's charter was issued under date of December 4, 1958.

The tentative meetings schedule calls for four regular meetings during the year—February 26, May 28, October 1, and December 3, 1959. Special meetings to be called as required.

The program for the meeting of February 26th featured a panel discussion of "The Role of Contract Surveying for State, County, and City Governments." The meeting was held in Salt Lake City.

The membership roster of the Utah Section, as of January 1, 1959, showed a total of 48 members in the Section.

—Clifford G. Bryner
Secretary-Treasurer

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Personals

At a ceremony held in the office of the Philippine Defense Secretary Jesus Vargas, on Friday, November 7, 1958, at Camp Murphy near Manila, Rear Admiral **H. Arnold Karo,** Director of the Coast and Geodetic Survey, was awarded the Philippine Legion of Honor. The award was presented for his eminently meritorious services to the Philippines from 1924 to 1926, and again from 1932 to 1934, and since his appointment as Director of the Coast and Geodetic Survey in August, 1955.

A. C. Tuttle has been appointed Chief Topographical Engineer, Surveys and Mapping Branch, Department of Mines and Technical Surveys, Canada, to succeed S. G. Gamble who was recently appointed Director of the Branch.

Mr. Tuttle was born in Wallace Bay, Nova Scotia, and received his first training in topographical surveying as a student assistant during his undergraduate years at the Nova Scotia Technical College in Halifax.

After graduation in 1927 with a degree in civil engineering, he joined the Mines Department as a junior topographical engineer and embarked on a mapping career, which during the last 31 years, has taken him to the territories and to every province except Prince Edward Island and Saskatchewan.

His knowledge of surveying and mapping techniques, particularly the reconnaissance methods used in the Yukon and Northwest Territories and in the northern parts of Alberta and British Columbia, as well as an active interest in air-transport possibilities, led to his being chosen, in 1950, to organize and supervise the Department's first helicopter-supported topographical survey in mountainous territory, north of Mayo, Yukon. Since then he has been in charge of several helicopter operations in western Canada.

In 1955, he was appointed to the position of Chief, Air Survey Section, where he was responsible for the photogrammetric operations of Topographical Survey.

Mr. Tuttle is a member of the Canadian Institute of Surveying, the Professional Institute of the Public Service of Canada, the Canadian Institute of Mining and Metallurgy, the American Society of Photogrammetry, and the American Congress on Surveying and Mapping.

Earl G. Harrington, Cadastral Engineering Staff Officer of the Bureau of Land Management, has been presented an Outstanding Career Award for 50 years of service as a surveyor of the public domain.

Clair A. Hill of Redding, California, has been appointed by Governor Knight to the State Board of Registration for Civil and Professional Engineers, to fill the unexpired term of Asa G. Proctor, deceased. The term has two years to run.

ACSM President **W. B. Williams** and ASP President **John I. Davidson** attended the 52nd Annual Meeting of the Canadian Institute of Surveying, at the Chateau Laurier, Ottawa, Canada, January 28–30, 1959.

Hal W. Hunt, formerly executive editor of *Civil Engineering,* has moved up to the position of editor, following the retirement of former editor Walter E. Jessup. Mr. Hunt was an associate editor of *Engineering News-Record* for a period of eight years during the 1940's.

Four members of the American Congress on Surveying and Mapping—**Harmon Rasnow, Albert V. Cocking, F. William Pafford,** and **Russell C. Brinker**—were listed as authors of papers presented at the two meetings of the Surveying and Mapping Division of the American Society of Civil Engineers held on Monday, February 9, 1959, during the Los Angeles Convention of the ASCE.

Ernest Steinbrenner and **Howard J. Teas** announce the admission of **William C. Teas** into the partnership of Teas and Steinbrenner on January 1, 1959. This firm has offices in both Hauppauge and Malverne, N. Y.

At its meeting of December 17, 1958, the Washington (D. C.) Society of Engineers elected its officers for the year 1959. **Alfred C. Stiefel,** a staff officer with the U. S. Geological Survey, becomes president, and Rear Admiral **Charles Pierce,** assistant director of the Coast and Geodetic Survey is vice president.

Victor H. Ghent, Secretary, Property Surveys Division, ACSM, has been elected president of the Virginia Association of Surveyors.

The Los Angeles County Flood Control District has announced the retirement of H. E. Hedger as Chief Engineer and the appointment by the Board of Supervisors of M. E. Salsbury as Chief Engineer, effective January 5, 1959.

A Christmas "card," in the form of an 8½-by 11-inch blueprint, has been received from **Charles C. Redman, Jr.,** Civil Engineers and Surveyors, Kennett, Missouri. The top half of the sheet is devoted to a cartoon showing a surveyor and his transit, both showing signs of wear, alongside a barbed wire fence. The verse below the cartoon is as follows:

Down here in the "Bootheel," at Christmas time,
When cotton's being ginned, and the corn's done fine,
When a man feels his labor has not all gone to waste
And living once more is somewhat to his taste,
It's a "sure-nuff" pleasure to wish all good cheer
And the best to all for a prosperous New Year.

The "Old Surveyor" and all his "crew"
Wish the best that can be had for each of you.
May God's greatest blessings upon you shine
As we worship His Son at Christmas time.

Deaths

Fred J. Spry, professor emeritus of civil engineering at Cornell University, died at his home in Ithaca, N. Y., December 17, 1958, at the age of seventy.

Professor Spry graduated from Lafayette College in 1914. For six years he was a maintenance of way engineer for the Lehigh Valley Railroad. He was assistant city engineer at Auburn, N.Y., for a year before joining the civil engineering faculty at Cornell as an instructor in 1923. He received the degree of Master of Civil Engineering from Cornell in 1929.

In 1924 he began teaching in the Cornell Summer Surveying Camp and continued even after his retirement. He also taught surveying in the summer camps of Manhattan College and Alfred University.

Just prior to his retirement, Professor Spry served a term as president of the Central New York Section of the American Society of Photogrammetry.

William Nelson Brown, whose name appears in the "Roster of Persons Who Attended the First Congress on Surveying and Mapping" and who has ever since that time been a quiet but continuously loyal supporter of ACSM, passed away at his home at 3420 Newark St., N.W., Washington, D.C., on January 12, 1959, at the age of 85 years.

He graduated from the Virginia Military Institute in 1893 and worked as a mining engineer in Alaska and Mexico during the early years of his professional career. About 1908 he established his own surveying and mapping firm in Washington, D.C. During both World War I and World War II, Mr. Brown did surveying and mapping, under contract, for the armed services.

One of his major accomplishments was the survey of the Mississippi River, from St. Louis, Mo., to St. Paul, Minn., in connection with flood control projects. He was also instrumental in persuading the Agricultural Adjustment Administration to use aerial photographs in determining farmers' compliance with soil programs.

Mr. Brown was a great-grandson of Jonathan Elliot, who worked with L'Enfant in the laying out of Washington.

He was a charter member of the American Society of Photogrammetry and a member of the American Society of Civil Engineers, the Society of American Military Engineers, the Washington Society of Engineers, and the Cosmos Club.

Charles L. Peckinpaugh, Jr., died November 30, 1958, at Silver Spring, Maryland. Interment was in the National Memorial Park at Falls Church, Virginia.

Mr. Peckinpaugh was born August 23, 1911, at Knoxville, Tennessee. He attended primary and secondary schools in that city and completed one year of a course in mechanical engineering at the University of Tennessee.

After several years of employment in Knoxville, he joined the Tennessee Valley Authority in November 1935, and, during much of 1936, he was the attendant at the TVA exhibit at the California Pacific International Exposition. He returned to the TVA again in 1942, after having held at least two other positions, as an instrument maker and was engaged in the repair, maintenance, and development of photogrammetric equipment.

During 1948, Peckinpaugh was employed as an instrument maker with the David W. Mann

(Continued on page 143.)

Annual Financial Statement

(As of December 31, 1958)

INCOME

Dues and memberships received ...	*1957*	*1958*	*Year ending 12/31/57*	*Year ending 12/31/58*	*Difference*
Individual	4067	4920	$20,408.13	$24,791.52	+ $4,383.39
Library and sustaining	548	772	3,071.50	4,070.49	+ 998.99
Previous year's dues			402.00	80.00	– *322.00*
Total	4615	5692	23,881.63	28,942.01	+ 5,060.38
Publication sales			494.83	179.87	– *314.96*
Advertising			4,667.40	5,360.42	+ 693.02
Other income			1,390.58	1,878.99	+ 488.41
Annual meeting			6,731.22	6,302.41	– *428.81*
OPERATING INCOME			$37,165.66	$42,663.70	+ $ 5,498.04

EXPENDITURES

Journal	$15,397.97	$18,306.19	+ $ 2,908.22
Salaries, office expenses, etc.	9,780.58	13,243.78	+ 3,463.20
Travel		586.77	+ 586.77
Technical divisions	414.34	2,152.81	+ 1,738.47
Other authorized expenditures	400.00	39.03	– *360.97*
TOTAL EXPENDITURES	$25.992.89	$34,328.58	+ $ 8,335.69
NET INCOME	$11,172.77	$ 8,335.12	– $ *2,837.65*

ASSETS

Bank balance	$23,667.61	$12,662.10	– *$11,005.51*
Bonds and savings accounts	46,307.75	60,385.34	+ 14,077.59
Property	3,102.07	3,362.41	+ 260.34
Advance payments	41.28	379.53	+ 338.25
Accounts receivable	1,200.00	1,385.67	+ 185.67
TOTAL ASSETS	$74,318.71	$78,175.05	+ $ 3,856.34

LIABILITIES AND NET WORTH

Advance dues paid	$11,092.67	$11,285.15	+ $ 192.48
Accounts payable	4,671.26		– *4,671.26*
TOTAL LIABILITIES	$15,763.93	$11,285.15	– *$ 4,478.78*
NET WORTH	**$58,554.78**	**$66,889.90**	$ 8,335.12

JOHN M. AMSTADT, *Chairman*
Budget and Finance

MEETINGS

PAST, PRESENT, AND FUTURE

The Commonwealth Survey Officers' Conference will be held August 17–26, 1959, at the Department of Geography, Downing Place, Cambridge, England, with subsequent visits to places of interest in and around London.

Engineering Progress Exposition to be held June 17–20, 1959, at the Hotel Commodore in New York City under the sponsorship of the National Society of Professional Engineers in conjunction with that organization's New York chapter.

The Seventh Annual Convention of the California Council of Civil Engineers and Land Surveyors was held at the Statler-Hilton Hotel, Los Angeles, California, January 22–24, 1959.

A meeting of the East Bay Council on Surveying and Mapping was held December 17, 1958, at San Leandro, California.

The Third Annual Surveying and Mapping Conference was scheduled to be held in Salt Lake City, Utah, December 11–12, 1958.

The Seventh Annual Conference of Indiana Land Surveyors was held at Purdue University, Lafayette, Indiana, January 15–17, 1959.

The Annual Meeting of the Massachusetts Association of Civil Engineers and Land Surveyors was held in Boston on December 6, 1958.

The 19th Annual Land Surveyors Conference and Exhibition, sponsored by the Land Surveyors Division of the New Jersey Society of Professional Engineers, was held at Rutgers University Commons, New Brunswick, N.J., on January 17, 1959, with members of the American Congress on Surveying and Mapping from the Middle Atlantic States participating.

The Michigan Society of Registered Land Surveyors held its 18th Annual Meeting at Travers City, Michigan, February 12–14, 1959.

The Virginia Association of Surveyors held its 11th Annual Meeting at the Chamberlain Hotel in Old Point Comfort, Va., on February 6–7, 1959.

The 52nd Annual Meeting of the Canadian Institute of Surveying was held at the Chateau Laurier, Ottawa, Canada, January 28–30, 1959.

The annual meeting of the Ontario Association of Land Surveyors was held at the Sheraton-Brock Hotel, Niagara Falls, Ontario, February 16–18, 1959.

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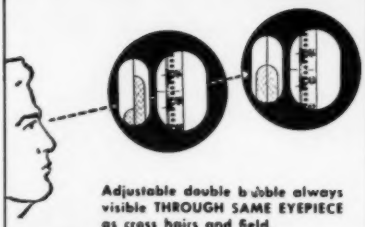

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NEW MEMBERS

INDIVIDUAL MEMBERSHIPS

ADAMS, Claybourne James, 29637 MacIntyre Ave., Livonia, Mich.—Chief of Party for David C. Adams

ADAMSON, Von G., 65 West 3rd South, Salt Lake City 1, Utah—Owner, General Office Supply Co.

AGER, L. E., 63 Gresham St., Ashland, Oreg.—Surveyor

ALGER, Morton G., 1727 Okeechobee Rd., Fort Pierce, Fla.—Location Engineer, State Road Department

AMEN, Jim M., Wyoming Highway Dept., State Office Bldg., Cheyenne, Wyo.—Cartographic Engineer

ANDRES, Russell S., 68 Belleview Ave., Southington, Conn.—Surveyor, Goodkind & O'Dea

BACON—Ronald E., Route 1, Box 91, Leavenworth, Kans.—Assistant City Engineer, Atchison, Kans.

BAKER, Quentin E., 803 Fairground Rd., Route 2, Rolla, Mo.—Cartographer, U.S.G.S.

BALATA, Kenard Da Silva, Rua Paulo Barreto 74, Rio de Janeiro, Brazil—Compilation Chief, Lavantamentos Aerofotogrametricos, S.A.

BARROW, Robert D., 9921 Berwick St., Affton, Mo.—Cartographer, A.C.I.C.

BAUER, Alex, 56-15 229th St., Bayside, L. I., N. Y.—Land Surveyor, Theo. E. Schaff

BEACH, Foster J., Jr., 3372 Chili Rd., Rochester 24, N. Y.—Senior Civil Engineer, New York State Department of Public Works

BEAVER, Eugene, Jr., 4410 Fairbanks Ave., Riverside, Calif.—Draftsman, J. E. Davidson, Civil Engineer

BISHOP, Stauffer C., 1048 East 95th St., Seattle 15, Wash.—Engineering Designer, Corps of Engineers, U. S. Army

BISHOP, William Lionel, 608 Chinquapin Drive, Marietta, Ga.—Engineer, Georgia Power Co.

BLACKBURN, R. R., Engr. III, Room 321, City Hall, First and Mission Sts., San Jose 10, Calif.—Engineer, City of San Jose

BLOYE, E. D., P. O. Box 445, Hot Sulphur Springs, Colo.—County Surveyor, Grand County, Colo.

BORST, Robert C., c/o Hill & Ingman, 3104 Western Ave., Seattle 1, Wash.—Civil Engineer

BOSSEMEYER, P. C., 4931 Daggett Ave., St. Louis 10, Mo.—Sales Manager, Keuffel & Esser Co.

BOURNE, C. B., 412 Moulton Ave., Raton, N. Mex.—City Engineer

BRADLEY, Verne O., 580 Capitol Office Bldg., Oklahoma City 5, Okla.—Supervisor, Oklahoma State Highway Department of Statistics

BRADY, K. E., 4931 Daggett Ave., St. Louis 10, Mo.—Sales Manager, Keuffel & Esser Co.

BRAMAN, Robert A., Mayflower Ridge Drive, Wareham, Mass.—Supervisor, Walter E. Rowley

BRANTLEY, Draper, 706 West Riverside Drive, Carlsbad, N. Mex.—Farmer

BREDAL, Roy H., Sr., P. O. Box 2245, Station A, Spartanburg, S. C.—Cartographer, Soil Conservation Service, U.S.D.A.

BRENNAN, James F., 2048 Market St., San Francisco, Calif.—Vice President, Daniel Coleman Engineering Co.

BRODNAX, Ernest N., 502 McCreight St., Bastrop, La.—Land Surveyor, Louisiana Department of Highways

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(Continued from page 138.)

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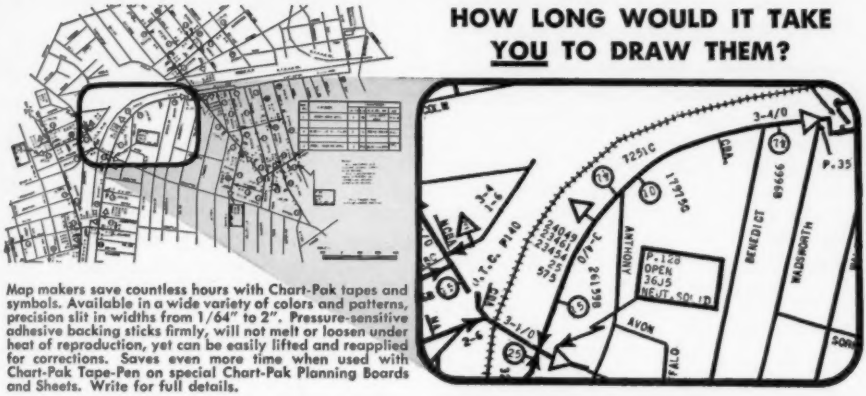

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(Continued on page 136.)

A. Lincoln—Surveyor

By KENNETH C. CROWDER*

ABRAHAM LINCOLN came to Illinois at the age of 21. He was a strong, energetic, ambitious young man who served his community and later his country in various capacities.

Many people feel that one of his early occupations, that of land surveying, had much to do with his self-reliance and his ability to make prompt decisions as demonstrated in his years as President. Also this early training as a surveyor contributed to his capacity for close observation and intelligent investigation of facts and situations.

Economic necessity coupled with his ambition to better himself is responsible for Lincoln becoming a surveyor. While serving as postmaster of New Salem in 1833, he was offered the appointment of Deputy County Surveyor, by County Surveyor, John Calhoun, who was an Andrew Jackson man. At first Lincoln hesitated to accept, knowing that there was a conflict in the political allegiance of the two men. When he was assured that such a conflict would not hinder his usefulness as a surveyor, he accepted and immediately began to prepare himself.

As usual, he got help from his old friend and teacher, Mentor Graham. The two spent many late evening and early morning hours discussing Robert Gibson's "Theory and Practice of Surveying" and Flint's "Treatise on Geometry, Trigonometry and Rectangular Surveying."

A survey Lincoln made for Squire Golby in January, 1834, was probably the first survey he made. It covered farm property about ten miles northeast of New Salem. About the same time he surveyed eight hundred acres for Reason Shipley. This well preserved, original survey is still in the hands of Shipley's descendants. There are records of numerous other surveys made by Lincoln during the time (1833–1836) he also served as Postmaster of New Salem. In this period the Illinois country was filling up with settlers. Division lines for the newly acquired farms had to be located for the first time. Land traders and speculators were becoming active laying out towns, selling lots, etc., wagon roads were being surveyed and opened for travel. He found time to deliver some mail as he went about his surveying matters. Legend has it, some of the mail was carried in his high, stovepipe hat, at no inconvenience to him.

Earlier, in the 1820's, the Illinois State Legislature had established the following prices for survey work:

For establishing each quarter section line: $2.50.

For establishing each half section line: $2.00.

For each town lot: 37½ cents.

For one survey Lincoln received two buckskins which he had "foxed" to his pants by his friend, Hannah Armstrong, to protect his long legs from the briars and underbrush while on field work in connection with land surveys.

Evidences of Lincoln's skill as a surveyor are not uncommon in Illinois. Besides laying out roads, establishing farm boundaries, and surveying school sections, he laid out the original towns of New Boston, Huron, Bath, and Albany, all in Illinois. These maps indicate that he was a painstaking draftsman and his work was neat and legible. This in spite of the fact that his tools and instruments were crude. The metal chains in those days were subject to wear, thus becoming inaccurate. Sometimes measurements were made by the wheel of the buggy or wagon ridden in by the surveyor; thus distances so measured were not too accurate because of "losing count" and the ruts and holes in the surface of the roads or the ground. Lincoln used a length of "grapevine" for some of his measurements.

There are some persons who may have doubts about Lincoln's ability and standing as a surveyor. Those persons of his generation and afterward who knew him or had occasion to retrace or examine his work will bear witness to the fact that he was a good practical surveyor. At the sixth annual meeting of the Illinois Society of Engineers and Surveyors held in Springfield in 1858, a dispute arose among those in attendance as to the prevailing law to be followed by surveyors. Lincoln had by now become an outstanding Lawyer. For this reason as well as his early occupation as a surveyor, the convention asked him for his opinion. He accepted the assignment and wrote the following opinion:

* Manager, National Title Division Office, Chicago, Illinois.

EDITOR'S NOTE: The following article appeared in the *Lawyers Title News*, Vol. XIII, No. 2, February 1958, and is reprinted by permission.

"The 11th Section of the Act of Congress, Approved Feb. 11, 1805, prescribing rules for the subdivision of sections of land within the United States system of surveys, standing unrepealed, in my opinion, is binding on the respective purchasers of different parts of the same section, and furnishes the true rule for surveyors in establishing lines between them. That law being in force at the time each became a purchaser, becomes a condition of the purchase.

"And by that law, I think the true rule for dividing into quarters, any interior section, or section which is not fractional, is to run straight lines through the section from the opposite quarter section corners, fixing the point where such straight lines cross, or intersect each other, as the middle, or center of the section.

"Nearly, perhaps quite, all the original surveys are to some extent erroneous, and in some cases the sections, quite so. In each of the latter, it is obvious that a more equitable mode of division than the above might be adopted; but as error is infinitely various, perhaps no better single rule can be prescribed.

"At all events, I think the above has been prescribed by the competent authority."

Springfield, Jany. 6, 1859

A. LINCOLN

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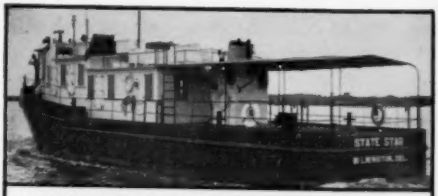

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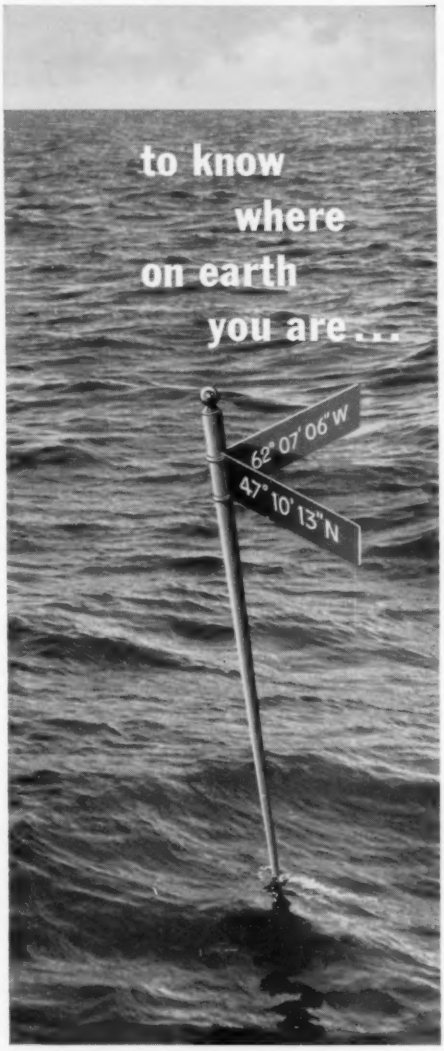
(Continued from page 26.)

ACSM President is to see continued spread in the development of local Sections. Living in an area where few members are able to get to the annual Washington meetings, he is especially aware of the need for local meetings, not only to spur growth of ACSM, but also to develop organizations able to deal with local problems affecting the surveyor. He will welcome communications from anyone in areas where need for new Sections may exist.



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A CORRECTION

It has been called to our attention that an error crept into the table on page 466 of the October–December 1958 issue of SURVEYING AND MAPPING. The numerator in the fraction in the heading for column (4) should be "πDR," instead of "DR" as printed.

—EDITOR

REVIEW COURSE IN LAND SURVEYING

The Division of Extension and General Studies of the University of Virginia (Northern Virginia Center, 1206 North Quincy St., Arlington, Va.), is offering a review course in land surveying, which will begin April 13, 1959, and meet Monday and Wednesday evenings, from 7:00 to 9.00 P.M., for a total of 12 meetings. The meetings will be held at the University College, at Bailey's Crossroads, and will cover computing, the use of calculators, topography, and interpretation of descriptions of property. Minimum enrollment 14. Fee $15.00. Instructor, Mr. Marshall. For further information, communicate with the Northern Virginia Center.

TYPE II TAVISTOCK THEODOLITE

Precision Instruments Inc., Troy, N. Y., is now offering to the American market the Type II Tavistock Theodolite manufactured by Cooke, Troughton & Simms Ltd., in England. This instrument has an internal focusing telescope, optical plummet, optical micrometer, and both the horizontal and vertical circles may be read to one second of arc. Descriptive literature is available on request.

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NEW MAILING ADDRESSES

The CANADIAN INSTITUTE OF SURVEYING and its journal, *The Canadian Surveyor,* may be addressed at P. O. Box 3151, Postal Station C, Ottawa, Ontario, Canada.

"SLIDE RULE? MAY I HELP . . ."

A 24-page two-color booklet, written and illustrated by Don Herold, and containing valuable information for any student or professional about to buy a slide rule, is available for the asking from Keffel & Esser Co., Adams and Third Streets, Hoboken, N. J.

1959 GURLEY EPHEMERIS

The 1959 Gurley Ephemeris is now available to practicing surveyors and engineers and to instructors and students of surveying. The 1959 edition runs to 96 pages, contains numerous useful tables and charts, and may be obtained from W. & L. E. Gurley, Troy, N. Y.

FENNEL MOVES TO CLIFTON, N. J.

Fennel Instrument Corp. of America, formerly in Long Island City, has moved to new quarters at 50 Colfax Avenue, Clifton, New Jersey.

The firm is the sole U. S. importer of surveying instruments manufactured by Otto Fennel Sohne, Kassel, West Germany. Concurrent with removal to the new quarters, Fennel Instrument Corp. of America has added a number of new dealers.

(Continued from page 122.)

7th Annual Conference Indiana Land Surveyors

The Indiana Society of Professional Land Surveyors, and the School of Civil Engineering and the Division of Adult Education of Purdue University jointly sponsored the 7th Annal Conference of Indiana Land Surveyors, which was held on the campus of Purdue University January 15–17, 1959.

There was an evening session on the 15th which was devoted to the Tellurometer.

Friday, the 16th, was given over to registration, inspection of exhibits, morning and afternoon sessions for the presentation of papers, a luncheon, and a dinner meeting in the evening, at which Paul E. Milton, of the History Department at Purdue, spoke on "Hoosier History and the Surveyor."

The morning of Saturday, the 17th, was devoted to reports of committees. After lunch the program included two papers—"The Planning and Design of Subdivisions" and "Model Subdivision Control Ordinances."

Programs for the ladies were provided for Friday afternoon and evening and for Saturday morning.

Practicing Engineers and Surveyors of Wyoming

John Bereman of Cody was elected president of Practicing Engineers and Surveyors of Wyoming at their annual convention in Cody. He succeeds Arthur Volk.

Other officers elected include John Lambert of Douglas, vice president; H. L. Worthington of Casper, secretary-treasurer; George Donnell of Worland, Elmer Johnston of Casper, and Charles Spurlock of Lander, directors.

The 1959 convention will be held in Lander during the second week of December.

Fifteen of the 26 members of the association attended the one-day convention and heard Robert Streeter of Casper address the group on the professional status and the public responsibilities of engineers and surveyors.

A brochure to be distributed to the public, explaining fees and public services, is now being edited prior to publication and distribution by the association.

Central New York Society of Land Surveyors

At its annual meeting, January 6, 1959, the Central New York Society of Land Surveyors, which became an affiliate of the American Congress on Surveying and Mapping on December 4, 1958, elected the following officers for 1959:

President—Henry Henninger
Vice President—Peter Gursky
Secretary-Treasurer—Wm. H. Rowell
Directors—
Jack Cottrell
Ovid White
Louis Jones
Roswell Cull
R. O. Hoffmann
Harold Tarbell

Virginia Association of Surveyors

At the 11th Annual Meeting of the Virginia Association of Surveyors, held at Old Point Comfort, Va., February 6–7, 1959, the following officers were elected:

Victor H. Ghent, *President*
E. Stewart Ball, *Vice President*
Merlin McLaughlin, *Secretary-Treasurer*
J. Williamson Clark, *Director* (2 years)

A more complete report on the meeting will be available for the next issue of SURVEYING AND MAPPING.

(Continued from page 129.)

Company in Boston. In 1949 he was employed as an instrument maker and later as a mechanical engineer in the Topographic Branch of the U. S. Geological Survey.

In the latter part of 1953, he joined Photogrammetry, Inc., of Silver Spring, Maryland, and, at the time of his death was Technical Vice President and a member of the board of that organization.

Mr. Peckinpaugh was a member of the American Society of Photogrammetry, the Optical Society of America, and the American Association for the Advancement of Science, as well as a member of ACSM.

APPLICATION FOR MEMBERSHIP

I am interested in surveying and mapping and hereby apply for membership in the American Congress on Surveying and Mapping. I enclose $5.00 (U. S. and Possessions), $6.00 (Foreign) in payment of annual dues.

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